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Guidelines and Register for Evaluation of Great Lakes Dredging Projects: Report of the Dredging Subcommittee

Dredging Subcommittee

Report to the
Great Lakes Water Quality Board

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Report of the
Dredging Subcommittee

to the
Water Quality Programs Committee
of the
Great Lakes Water Quality Board

January, 1982

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Summary, Conclusions and Recommendations

SUMMARY AND CONCLUSIONS

In addressing the development of compatible guidelines and criteria for dredging activities in the boundary waters of the Great Lakes System, the Dredging Subcommittee referred to the report of the International Working Group on the Abatement and Control of Pollution from Dredging Activities as well as research results and experience produced since the report's publication in 1975. It was noted that specific programs, notably the Dredged Material Research Program of the U.S. Army Corps of Engineers, the IJC Reference Group on Pollution from Land Use Activities (PLUARG) and the development of legislation, policy and guidelines for the control of toxic substances, have produced results, recommendations and measures which have the potential to significantly influence dredging and dredged material disposal decisions in the Great Lakes.

The Subcommittee reaffirms the site-specific approach to the environmental review of dredging projects as recommended by the International Working Group on Dredging, and has produced guidelines to be considered in such a review. In an evaluation of sediment quality at a dredging site, there are too many variables involved to provide more than the general guidelines contained in Chapter 5. The conceptual approach taken in the guidelines is based on the principle of non-degradation and does not differ markedly from that presently used on the lakes and is similar to procedures followed in the ocean dumping legislation of the United States and Canada. Essentially, the basic components of a project evaluation consist of a review of existing site-specific historical and ecological information, an assessment of the physical, chemical and biological characteristics of the dredged material and an evaluation of dredged material disposal options.

Methods to determine and evaluate the biological significance of sediment contaminants are still in the development stage and further research is required in the field of toxics and bioassessment.

RECOMMENDATIONS

The Dredging Subcommittee recommends that:

1. The principle of non-degradation should be fundamental in the environmental assessment of dredging activities in the Great Lakes.

2. Significant sources of sediments and contaminants to the Great Lakes should be identified and quantified where possible such that the inputs due to dredging can be placed in perspective.

3. The implications and potential environmental impacts of dredged material disposal options should be fully assessed during project evaluation.

4. More research should be directed to bioassessment procedures for determining the biological availability and impact of sediment contaminants.

5. Programs to identify and control sources of sediments and contaminants within watersheds should be encouraged.

1. Introduction

The International Working Group on the Abatement and Control of Pollution from Dredging Activities was established in November 1972 in compliance with the Great Lakes Water Quality Agreement. The International Working Group reviewed existing dredging practices, programs, laws and regulations in its 1975 Report. In 1978 the Research Advisory Board's Expert Committee on Engineering and Technological Aspects reported on dredged material disposal employing confinement facilities and recommended assessment of alternative disposal options.

The revised Water Quality Agreement (International Joint Commission, 1978), signed by the governments of the United States and Canada on November 22, 1978, recommended the establishment of a Subcommittee on Dredging under the auspices of the Water Quality Board. The terms of reference for this Subcommittee, outlined in Annex 7 of the Agreement and later confirmed and approved by the Water Quality Board at its 36th meeting, February 13, 1979, are as follows:

> The Dredging Subcommittee (DS) will assist the Implementation Committee (IC) of the Great Lakes Water Quality Board (WQB) by:
>
> a. reviewing the existing practices and policies in both countries relating to dredging activities, as well as the previous work done by the International Working Group on Dredging, with the objective of developing by December 1, 1979 compatible guidelines and criteria for dredging activities in the boundary waters of the Great Lakes System;
>
> b. maintaining a register of significant dredging projects being undertaken in the Great Lakes System with information to allow for the assessment of the environmental effects of the projects, including the long term effect of both dredging and disposal of toxic sediments. The register shall include pertinent statistics to allow for the assessment of pollution loadings from dredged materials to the Great Lakes System;
>
> c. recommending procedures for encouraging the exchange of information relating to development of dredging technology and environmental research;
>
> d. identifying specific criteria for the classification of polluted sediments of designated areas of intensive and continuing dredging activities within the Great Lakes System and
>
> e. preparing reports on items a), b), c), d) and undertaking other activities as directed by the Water Quality Board.

Membership: The Dredging Subcommittee will be composed of representatives of the jurisdictions in the Great Lakes Basin and the agencies engaged in dredging activities. A chairman shall be designated by the WQB each year.

The Dredging Subcommittee held its first meeting in the Regional Office of the International Joint Commission at Windsor, Ontario, on March 23, 1979. The membership of the Subcommittee can be found in Appendix 1.

The following report addresses the Subcommittee's first two terms of reference, namely (a) reviewing existing dredging practices and policies and the International Working Group's 1975 Dredging Report and developing compatible guidelines and criteria for dredging activities in the boundary waters of the Great Lakes System, and (b) maintaining a register of significant dredging projects being undertaken in the Great Lakes System.

INTERNATIONAL WORKING GROUP ON THE ABATEMENT AND CONTROL OF POLLUTION FROM DREDGING ACTIVITIES

The international concern for the poorly understood environmental impacts of dredging and disposal operations was recognized in the original Great Lakes Water Quality Agreement of April 1972. An International Working Group on the Abatement and Control of Pollution from Dredging Activities was established in compliance with Article V, Section (f) of the Agreement in November 1972 and its report was presented in May 1975.

The International Working Group's report was the first attempt to consolidate the information on Great Lakes dredging activities. It was determined that over 10 million m^3 of sediment are dredged annually in the Great Lakes and more than 90% of this is associated with the maintenance of harbours and waterways for commercial navigation (Figure 1). Approximately one-half of the dredging is occurring on Lake Erie. The report identifies the roles of various government agencies involved with dredging; reviews policies, practices and legislation pertinent to dredging; discusses environmental concerns and the components of site-specific project evaluations and makes a valid argument for the possible environmental and other benefits that might be derived from dredging operations. As such, the report constitutes a significant and valuable reference document.

One of the greatest difficulties facing the International Working Group was the identification of specific guidelines or criteria, a situation identified by the Water Quality Board Annual Report of 1975, to characterize dredged material as either contaminated or uncontaminated, in fact, the Group concluded that it could find no set of criteria that was applicable to the varied conditions and situations encountered throughout the Great Lakes and recommended that future evaluations of dredging projects be site-specific in accordance with a general set of guidelines.

The lack of specific criteria for identifying contaminated sediment and a requirement for site-specific evaluations, which, in effect could be construed as an environmental assessment for every dredging project, were of concern to various reviewers of the report because of the envisaged difficulties in implementing and administering a basin-wide regulation and approval system. In

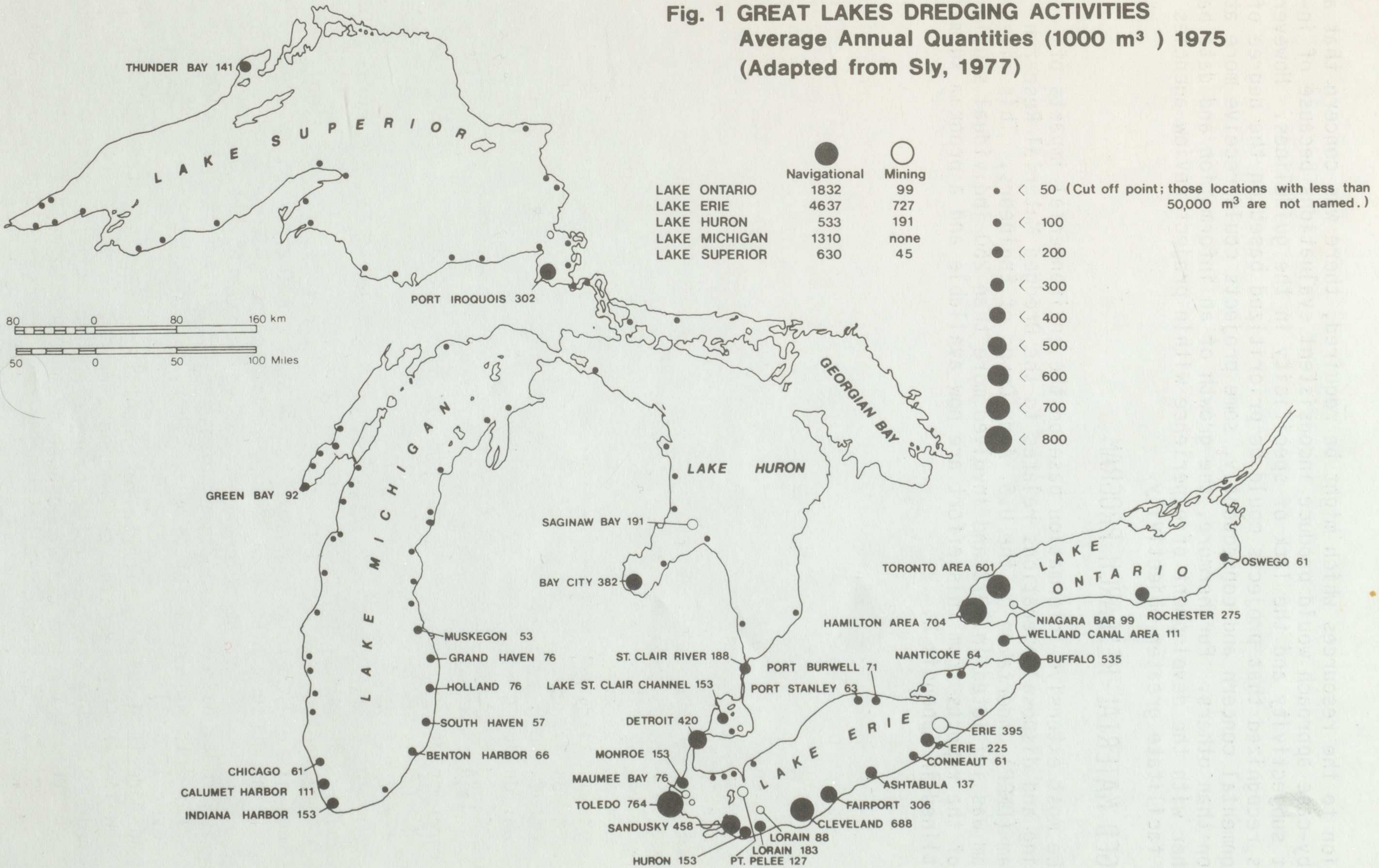

Fig. 1 GREAT LAKES DREDGING ACTIVITIES
Average Annual Quantities (1000 m³) 1975
(Adapted from Sly, 1977)

addition to the resources which might be required, there was concern that a case-by-case approach would produce inconsistent evaluations because of inherent subjectivity and the lack of specificity in the guidelines. However, it was recognized that projects could be prioritized based on the degree of environmental concern and consequently, some projects could receive more attention than others. Furthermore, the growth of an information and data base together with the development of experience within project review agencies would facilitate greater objectivity.

DREDGED MATERIAL RESEARCH PROGRAM

The most extensive information base on the environmental impacts of dredging and disposal operations relates to the Dredged Material Research Program (DMRP) undertaken by the U.S. Army Corps of Engineers. This five-year program was initiated in 1973 and involved more than 250 individual studies. Most of the reports from this effort are now available and a program summary is outlined in Appendix 2.

2. Background

ENVIRONMENTAL CONCERNS AND DREDGING

Examples of the degradation of the environment and biota of the Great Lakes due to man's activities are numerous. Substantial changes in the fishery (Beeton, 1969) including the decline and virtual extinction of the indigenous oligotrophic fish species are partially attributed to pollution and the decline of preferred habitat. Also, the nutrient enrichment and subsequent eutrophication of lake waters have contributed to localized and sometimes extensive depletion of dissolved oxygen in bottom waters (Burns and Ross, 1972).

Perhaps the most obvious changes occurring in the lakes are those taking place in the sediments. Populations of benthic organisms, which form relatively stable communities that integrate changes over long time intervals, have undergone shifts in species composition, distribution and abundance (Beeton, 1969; Cook and Johnson, 1974; Delorme, 1977). Along with the heavy metal enrichment of the surficial sediments of the Great Lakes (Kemp and Thomas, 1976; Kemp et al., 1978; Leland et al., 1973; Walters et al., 1974) there is increasing concern for other persistent contaminants which are being identified including chlorinated organics such as DDT and its derivatives, PCBs and mirex. It should be noted that for many contaminants, e.g., mercury and PCBs - the extent to which sediments function as a net source or a net sink has not been determined.

The Pollution from Land Use Activities Reference Group (PLUARG, 1978) determined the percentage of the tributary pollutant loads to the lakes that is associated with sediments and concluded that, in terms of an overall lake load, the sediment associated fraction of many pollutants constitutes a substantial proportion of the total loading of those pollutants. In many cases the sedimentation of tributary loadings in harbours has contributed to both the requirement for maintenance dredging and the poor quality of the sediments in harbours. Other loadings are due primarily to industrial and municipal sources. The extent to which dredging contributes to the translocation of sediments and contaminants to the open lake system is not clear. Kemp et al. (1977) suggested that dredging could contribute approximately 10% of the fine-grained sediment to Lake Erie. Insofar as much of the sediment dredged in Lake Erie is associated with highly industrialized areas and contaminants are mostly associated with the finer grain sizes of sediment, it can be postulated that contaminant loads associated with dredging may be substantial. Much of the contaminant load, however, is bound to fine particles and unavailable to biota, although what is available may be important.

The DMRP concluded that many of the water quality concerns relating to the short-term release of contaminants to disposal site waters are unfounded in most cases. Also, it was found that benthic organisms would rapidly recolonize open water disposal sites particularly when the physical characteristics of the dredged material resembled the natural background conditions. Contaminant uptake by aquatic organisms, however, remains a problem and a recommendation is made for the inclusion of bioassay tests as an integral part of evaluative criteria.

POLLUTION FROM LAND USE ACTIVITIES REFERENCE GROUP (PLUARG)

The ultimate resolution of dredging and disposal problems rests with the identification and control of the sources of sediment and contaminants in the watershed. The recently concluded efforts of the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG, 1978) addresses the impacts of various land use practices on the Great Lakes. A recommendation is made for the development of management plans to reduce loadings of phosphorus, sediments and toxic substances derived from agriculture and urban areas. The extent to which this recommendation is endorsed and implemented by the various jurisdictions will influence the quality and quantity of sediments dredged in the Great Lakes.

Agencies involved in the evaluation of dredging projects are advised to refer to the numerous reports produced by PLUARG, particularly those that pertain to intensive watershed studies in their jurisdictions.

POLLUTION ABATEMENT MEASURES

It should be recognized that the development and implementation of pollution control legislation, regulations and programs (U.S. Toxic Substances Control Act, NPDES permit program, Environmental Contaminants Act, Canada) will affect the quality of sediments in the Great Lakes and thereby influence dredged material disposal options. Also, increased surveillance and improved analytical capabilities are providing a clearer definition of impacts associated with dredging and disposal activities.

3. Existing Policies and Practices

LEGISLATION AND POLICIES

The International Working Group report of 1975 included a fairly comprehensive coverage of the jurisdictional legislation and policies pertinent to dredging activities in the Great Lakes. The significant changes which have occurred since that time are discussed below.

U.S. - FEDERAL

In 1977, amendments to the Clean Water Act brought about some changes to Section 404 of the Act. The changes are primarily contained within Sections 404 (g), (h), and (t). Although the Corps of Engineers retains permitting authority for the traditionally navigable waters of the United States, Sections 404 (g) and (h) allow the States to assume the permitting authority for the remaining waters of the United States.

Section 404 (t) gives a State the authority to issue permits to federal agencies for the discharge of dredged or fill material in any portion of the navigable waters within the jurisdiction of the State. However, this section is not to be construed as affecting or impairing the authority of the Corps of Engineers to maintain navigation.

The Resource Conservation and Recovery Act of 1976 has implications for dredged materials disposal. If dredged materials are deemed to be hazardous wastes by virtue of failing a prescribed extraction procedure test, they are then subject to various regulatory requirements governing the transportation, storage, and disposal of such wastes. Due to the recent promulgation of the implementing regulations for the Act, only limited testing of dredged materials has been done so far to determine whether the materials were subject to the hazardous wastes requirements.

MINNESOTA

The Minnesota Pollution Control Agency (MPCA), which is empowered to regulate dredging activities through Minnesota Statutes, Chapters 115 and 116, generally opposes wetland and open water disposal of dredged material. Such disposal may be considered for a project which can be thoroughly justified and which can be demonstrated to provide benefits which outweigh the potential negative impacts. The MPCA has in the past used the EPA Guidelines for the Pollutional Classification of Great Lakes Harbour Sediments (Appendix 3) as part of the initial evaluation of a project. However, because the guidelines have not been related to potential biological impacts of the sediments, they are not used extensively or exclusively.

WISCONSIN

Wisconsin considers dredged material a pollutant and no open water disposal is permitted. The State encourages the beneficial uses of dredged material, if available, but otherwise restricts disposal to confined or on-land disposal sites.

ILLINOIS

The Division of Water Resources (DWR) of the Department of Transportation, following approval of the Illinois EPA, Department of Conservation and the Corps of Engineers, issues permits in conjunction with the Corps of Engineers permits. The DWR is authorized to issue permits under the Illinois Constitution, Article 7 of the revised statutes, Chapter 24, Division 12, Chapters 11 and 34, Section 3001 (Krapohl, 1979).

INDIANA

In Indiana both the Stream Pollution Control Board and the Natural Resources Commission review dredging projects. The State does not have specific guidelines for dredging activities but has used those of the U.S. EPA.

MICHIGAN

The great majority of dredging projects by volume in Michigan are undertaken by the U.S. Army Corps of Engineers. In order to achieve effective coordination and compliance with the Federal Clean Water Act, the Corps' Project Review Committee was formed by the Department of Natural Resources in April 1978. This Committee, chaired by the Chief of the Water Management Division, with a representative from all interested divisions of the Department, reviews all Corps of Engineers' projects within the State. Upon acceptance by the Committee, the Corps is issued a water quality certificate under Section 401 of the Act.

Under this procedure a "Coordination Manual" was written and put into use to assure consistent review procedures. EPA Guidelines are used for the pollution classification of dredged material during the initial evaluation of a project.

OHIO

The Ohio EPA reviews dredging projects which fall under Section 404 of the Clean Water Act, or Section 10 of the Rivers and Harbors Act of 1899. Each project is evaluated on its own merits in a site-specific review.

PENNSYLVANIA

The Department of Environmental Resources evaluates dredging projects and will allow open water disposal if the U.S. EPA has determined that the material to be dredged is not polluted.

NEW YORK

The Department of Environmental Conservation regulates dredging under Section 15-0505 of the Environmental Conservation Law of New York. In special cases the New York Public Service Law, Article VIII could be used to consider environmental impacts of the dredging operation and the proposed dredged material disposal (International Work Group, 1975).

CANADA - FEDERAL

Provisions within the Fisheries Act dealing with the protection of fish habitat have been expanded with amendments effective September 1, 1977. The new provisions prohibit activities which result in the harmful alteration, disruption or destruction of fish habitat where fish habitat is defined as spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes. The Minister for the Department of Fisheries and Oceans can call for plans and specifications of proposed undertakings, require modifications and, if necessary, prohibit a specific undertaking.

The responsibility for administering these provisions in the Province of Ontario has been delegated to the Ontario Ministry of Natural Resources. However, some further delegation of authority is necessary before the Ministry can assume this responsibility in full.

ONTARIO

The Environmental Assessment Act, proclaimed in 1975, requires a proponent to submit an environmental assessment to the Minister of the Environment prior to an undertaking. The project may not proceed until the Minister has accepted the environmental assessment and given approval with the consent of the Lieutenant Governor in Council, effectively, the Cabinet. Public hearings may be called at the request of the public, the proponent or the government before a decision is reached.

At present, the Act applies only to provincial and municipal government undertakings and, under "grandfather" provisions of the Act, many of these are exempt. It is intended to apply the Act to the private sector some time in the future.

EXISTING PRACTICES

THE SITE-SPECIFIC EVALUATION OF DREDGING PROJECTS

Experience on the Great Lakes since 1975 supports the site-specific approach to project evaluation as recommended by the International Working Group. The variability of dredging projects, sediment characteristics and disposal solutions evident within the Great Lakes Basin necessitates such an approach and precludes the application of a universal set of criteria. To assist in these evaluations, both the U.S. Environmental Protection Agency and the Ontario Ministry of the Environment have produced guidelines for determining the pollution status of sediments based on bulk analysis or total concentrations of various sediment parameters (Appendix 3). The guidelines were never intended to be rigidly applied but are to be used in conjunction with other site-specific considerations, e.g. frequency of dredging, volume of material and availability of disposal options. It has been noted by the International Working Group in 1975 and later by the Great Lakes Water Quality Board and Research Advisory Board (1978) (Appendix 4) and, in fact, by the guidelines themselves, that these guidelines do not indicate the portion of the contaminant load that is biologically available, nor do they consider natural background concentrations of sediment constituents which may exceed the guidelines. The guidelines were and are still used to the extent that better evaluation techniques are not available or practised.

Sediment chemical data alone are not sufficient to assess potential environmental change. It is generally agreed that the best evaluative mechanism would be some form of bioassessment. Bioassessment of sediments would include determinations of acute toxicity, reproductive impairment and contaminant bioaccumulation potential for specified aquatic organisms. Unfortunately, the state-of-the-art is such that standardized methodologies and interpretative criteria are unavailable.

CONFINED DISPOSAL

Since 1975 there has been an increasing commitment to the use of confinement facilities for dredged material. In 1978 confined disposal was used for approximately 85% and 70% of the dredging quantities from United States and Canadian activities, respectively (Water Quality Board, 1979). The Working Group report of 1975 identified possible concerns with this form of disposal but noted that little information had been gathered on the environmental consequences of confining contaminated dredged material.

A substantial amount of experience has been gathered since 1975 pertaining to the economic, land use planning and environmental impacts of confined disposal. Confining contaminated sediment on land or in the shallow nearshore area can be effective in the retention and isolation of pollutants (Hoeppel et al., 1978 and Krizek et al., 1976). Therefore, it can be an environmentally preferred alternative to open water disposal. However, in some cases inadequate siting design and/or operation of confinement facilities has resulted in releases of contaminants to groundwater, streams and sensitive nearshore areas (Harrison and Chisolm, 1974; Chen et al., 1978). Also, substantial costs are involved and land use management conflicts frequently arise. It has become imperative that project review agencies fully assess the potential impacts of confined disposal during the evaluation of disposal options.

WETLANDS

Wetlands have been impacted to accommodate many types of land uses, including industry, housing, transportation, agriculture and recreation. Impact methods include dredging, filling, bridging, drainage and construction of dikes and levees. Such shoreline alterations and development that was once routinely permitted is now the subject of much concern.

No accurate data are available on total wetland loss. Wetland definitions are only now being standardized, and our original wetland heritage was never mapped or inventoried. The extent to which dredge and fill activities have contributed to the loss of wetland habitat on the Canadian portion of the Great Lakes is not known. On the U.S. side, it appears that few losses can be directly attributed to dredging activities. Dredge and fill impacts on wetlands as well as the various related policies and legislation are described in Appendix 5.

FILL OF NON-AQUATIC ORIGIN

Most jurisdictions and agencies do not have specific regulations or guidelines governing the dumping of non-aquatic fill into the Great Lakes and their tributaries. In most cases, however, legislation does exist which could be used or interpreted to regulate such dumping (see Appendix 6). In general, the same laws that regulate disposal of dredged materials regulate disposal of fill of non-aquatic origin. There is a paucity of information on the quality and quantity of fill and the location of its source and disposal sites.

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4. Great Lakes Dredging Activities

INTRODUCTION

The Dredging Register and Summary Tables found in Appendix 7 of this report meet the requirements of Section 1(b) of Annex 7 of the 1978 Great Lakes Water Quality Agreement, namely: "Maintain a register of significant dredging projects being undertaken in the Great Lakes System with information to allow for the assessment of the environmental effects of the projects. The register shall include pertinent statistics to allow for the assessment of pollution loadings from dredged materials to the Great Lakes System."

The register is presently maintained in a mini-computer system located at the IJC Great Lakes Regional Office in Windsor, Ontario. Reasonable requests for copies of specific portions of the register data or summary information based on the data contained in the register will be filled by the Regional Office. It is planned to update the register periodically and include additional information as identified by users. Suggestions for other kinds of information to be included or other improvements would be welcomed.

It is estimated that the register contains information on about 95 percent of all dredging in the Great Lakes Basin. The 5 percent that is probably unaccounted for can be attributed to small private dredging projects where volumes were not measured. Also, the user should note that the register only contains data for those portions of those harbours that were actually dredged during the 1975-1979 period. Some harbours and portions of harbours that are among the most contaminated in the Great Lakes Basin (i.e. Waukegan inner harbor, Sheboygan, Wisconsin; Indiana Harbor, upstream portion of Ashtabula River, Ohio) do not appear in the register since they were not dredged in this time period due to a lack of acceptable disposal sites. The register alone cannot be used directly to rank the harbours from most to least contaminated.

The information contained in the register enables the identification of Great Lakes dredging sites by country, jurisdiction, basin and year. It allows one to quantify and locate the volume of material being dredged and, in so doing, identify areas of intensive and continuous dredging. The data on chemical concentrations are then used to calculate pollutant loadings and identify problem areas with contaminated sediment. Over the years as more information is fed into the register, it should be possible, by analyzing trends in the volumes and contamination of maintenance dredging sediments, to be able to estimate the effectiveness of other water quality remedial programs (particularly PLUARG). Also, the record of disposal sites and the quality of their dredged materials may prove to be valuable information as witnessed by the present problem with old industrial and municipal landfills. Finally, the register will provide a record of dredging costs from excavation to disposal.

In this chapter, the data summarized in the dredging register including the extent of dredging activities in 1975-1979, dredging volumes and the extent of various means of dredged material disposal are discussed. Pollutant loadings to the lakes through dredging are also examined.

EXTENT OF DREDGING OPERATIONS 1975-1979

Until the early 1970's, little consideration was given to the environmental effects of dredging and dredged material disposal and the impact of such activities on Great Lakes water quality was poorly understood. Increased environmental awareness created a "climate of uncertainty" in which only the more urgent dredging projects were carried out. New regulations governing the quality and disposal needs (confined) for dredged materials were introduced at about the beginning of the 1975-1979 period which have tended to decrease dredging volumes in the Great Lakes. As well, reduced dredging volumes generally accompany higher lake levels and the 1975-1979 period has been one of relatively high water levels. It should be kept in mind, therefore, that this report does not deal with a typical dredging period, both in terms of the dredging volumes and the disposal methods used.

SPATIAL DISTRIBUTION OF DREDGING SITES

Figure 2 illustrates the spatial distribution of dredging locations in the Great Lakes. This map highlights the fact that the largest individual dredging sites are located on the Lower Lakes, particularly Lake Erie, and that generally more numerous but smaller projects are located in the Upper Lakes. Of the 97 dredging sites plotted on Figure 2, 69 are in the United States and 28 are in Canada.

DREDGE VOLUMES 1975-1979

A total of 23,036,851 m^3 of material was dredged from the 97 Great Lakes locations during the 1975-1979 five-year period. On average, 64 locations were dredged each year for an annual average dredging of 4,607,000 m^3. The mean annual Great Lakes dredging volumes for the period 1966-1972 was 8,700,000 m^3 (International Work Group, 1975). This is nearly twice the 1975-1979 annual average. This highlights the fact, noted earlier, that the 1975-1979 period is not a typical period as far as quantities are concerned.

Table 1 summarizes the total dredging volumes by country and by lake. These data illustrate the tremendous difference between the American and Canadian dredging volumes, with the United States dredging about 8 times more material than Canada. This can be explained by the greater American population and industrial activity but also by the fact that the U.S. Corps of Engineers, under the U.S. Rivers and Harbors Act of 1849, is responsible for the maintenance of all boundary water channels with the exception of the South East Bend Cut-Off Channel of the St. Clair River and the approaches to the Welland Canal.

Table 2 summarizes dredging volumes by country and year for the 1975-1979 period. United States dredging volumes showed a marked decrease during the early part of the period but appeared to level out toward the end. Canadian

FIG. 2. GREAT LAKES DREDGING ACTIVITIES 1975 - 1979

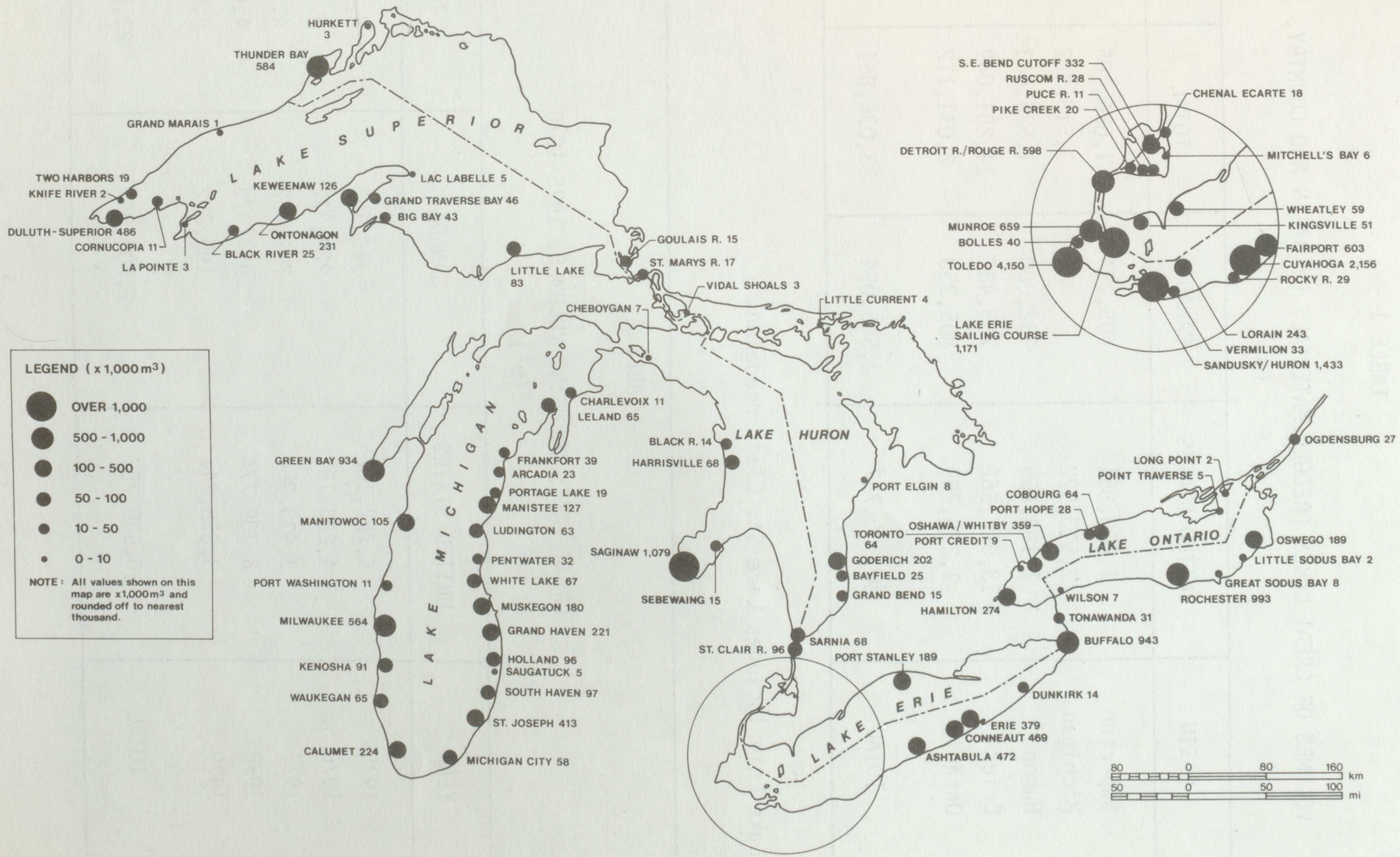


TABLE 1 VOLUMES OF GREAT LAKES DREDGED MATERIALS BY BASIN AND COUNTRY, 1975-1979 (m^3)				
BASIN	UNITED STATES	CANADA	TOTAL	% OF TOTAL
Superior	1,080,851	605,254	1,686,105	7
Michigan	3,513,922	0	3,513,922	15
Huron	1,192,663	332,000	1,524,663	7
Erie*	13,517,562	763,487	14,281,049	62
Ontario	1,225,759	805,353	2,031,112	9
TOTAL	20,530,757	2,506,094	23,036,851	100

*Lake Erie includes Lake St. Clair dredging.

TABLE 2 GREAT LAKES DREDGING VOLUMES, 1975-1979 (m^3)			
YEAR	UNITED STATES	CANADA	TOTAL
1975	4,752,102	345,355	5,097,457
1976	4,296,151	228,312	4,524,463
1977	3,933,984	787,762	4,721,746
1978	3,709,774	954,373	4,664,147
1979	3,838,746	190,292	4,029,038
TOTAL	20,530,757	2,506,094	23,036,851

volumes have been much more variable and do not follow any apparent trend. The total volumes dredged in the Great Lakes has been relatively constant over this five-year period.

Figure 3 illustrates the contributions of each of the Great Lakes to the total dredged volume and the importance of each country to the dredging volumes moved in each lake. Lake Erie clearly dominates Great Lakes dredging, accounting for 62% of the total volumes. Lake Michigan accounts for 15%, Lake Ontario 9%, and Lakes Superior and Huron each are responsible for 7%.

Table 3 summarizes the locations, volumes and rankings of the largest dredging sites in each of the countries. Toledo Harbor is by far the largest single dredging project site for the five-year period, almost doubling the volumes moved at the second largest site, the Cuyahoga River-Cleveland, also on Lake Erie. The first 11 sites in the ranking are in the United States. Thunder Bay, Ontario places 12th overall as Canada's largest volume dredging site.

TABLE 3

LOCATIONS OF LARGEST TOTAL DREDGING VOLUMES BY COUNTRY, 1975-1979 (1000 m^3)

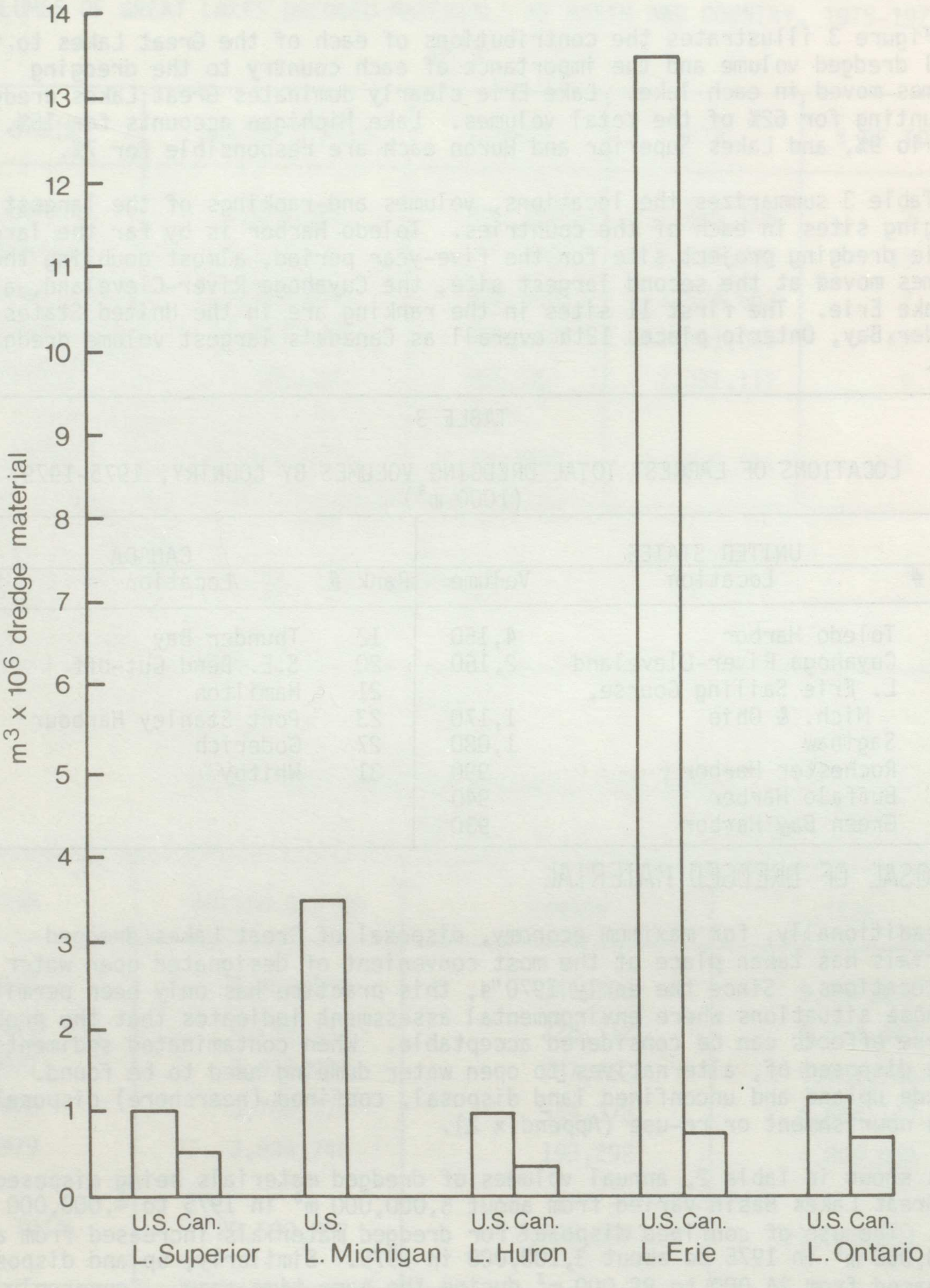
UNITED STATES			CANADA		
Rank #	Location	Volume	Rank #	Location	Volume
1	Toledo Harbor	4,150	12	Thunder Bay	580
2	Cuyahoga River-Cleveland	2,160	20	S.E. Bend Cut-off	330
3	L. Erie Sailing Course, Mich. & Ohio	1,170	21	Hamilton	270
4	Saginaw	1,080	23	Port Stanley Harbour	230
5	Rochester Harbor	990	27	Goderich	200
6	Buffalo Harbor	940	31	Whitby	190
7	Green Bay Harbor	930			

DISPOSAL OF DREDGED MATERIAL

Traditionally, for maximum economy, disposal of Great Lakes dredged materials has taken place at the most convenient of designated open water dumping locations. Since the early 1970's, this practice has only been permitted in those situations where environmental assessment indicates that the probable adverse effects can be considered acceptable. When contaminated sediments are to be disposed of, alternatives to open water dumping need to be found. These include upland and unconfined land disposal, confined (nearshore) disposal, beach nourishment or re-use (Appendix 2).

As shown in Table 2, annual volumes of dredged materials being disposed in the Great Lakes Basin varied from about 5,000,000 m^3 in 1975 to 4,000,000 in 1979. The use of confined disposal for dredged materials increased from about 2,000,000 m^3 in 1975 to about 3,100,000 in 1979. Similarly, upland disposal increased from 24,000 to 88,000 m^3 during the same time span. Conversely,

Fig. 3 VOLUME OF MATERIAL DREDGED (1975 - 1979)



the use of open lake disposal decreased from about 2,950,000 in 1975 to 780,000 m^3 in 1979. Beach nourishment volumes have remained relatively stable except for 1978, when it was not used at all. Finally, the re-use disposal option was not utilized in any of the years (Appendix 7.3).

As shown in Table 4, during the 1975-1979 period over 13 million m^3 or 58 percent of Great Lakes dredged materials were disposed of in confined facilities and almost 9,000,000 m^3 or 39 percent were still disposed of in the open lake. In comparison, upland and beach were insignificant and, re-use was non-existent. [To arrive at the net losses of sediments to the Great Lakes, upland and confined disposal were combined]. This shows that 61% of the materials are removed from the aquatic environment, and only 39% of the total volume dredged is disposed of at a location in the aquatic environment (i.e., open lake dumping plus beach nourishment). It is also interesting to note that the mix of disposal methods is almost identical for the two countries with only slight differences of 3% for confined, 2% for open lake, and 3% for beach disposal methods.

TABLE 4

DISPOSAL OF GREAT LAKES DREDGED MATERIALS, 1975-1979
(m^3)

DISPOSAL TYPE	U.S.	% OF U.S. TOTAL	CANADA	% OF CDN. TOTAL	TOTAL	% OF G.L. TOTAL
Upland	521,370	3	70,490	3	591,860	3
Confined	11,845,182	58	1,409,425	56	13,254,607	58
Beach	212,360	1	92,800	4	305,160	1
Open Lake	7,951,845	39	933,379	37	8,885,224	39
Re-use	0		0		0	
TOTAL	20,530,757	101	2,506,094	100	23,036,851	101

POLLUTANT LOADINGS

By virtue of their locations, harbours and shipping channels receive a variety of municipal, industrial and in many cases, tributary pollutant loadings which are often reflected in their sediments. Pollutants in materials dredged from harbours cannot be completely viewed as a loading to the lacustrine system. A certain portion of this sediment is located in zones of resuspension and is already an active component of the materials and chemical load circulating in the Great Lakes system. Similarly pollutants near the sediment surface may be actively cycled from solid to aquatic to biotic phases of the system and are hence not a new loading. For these portions of the pollutant burden in harbour sediments, dredging is simply a transport phenomenon more akin to longshore sediment movement, or propellor wash in shipping channels than a direct loading to the lake system. For that component of the total load of pollutants in dredged materials that is not cycling actively in the lacustrine environment (i.e., sediments in depositional areas below the zone of physical/chemical and biological interaction) the act of dredging and disposal in the lake is a loading in the same sense as tributary loading, atmospheric deposition or direct municipal industrial discharges. It has been possible to use information from the dredging register to determine the magnitude of total pollutant burdens in dredged materials. However, it has not been possible to isolate the components which should be viewed as transported load from that portion which should be viewed as a direct loading, nor has it been possible to account for the portion of each loading estimate that is bioavailable.

Using dredged materials volumes, density of dredged materials and sediment quality data (from the dredging register in Appendix 7), as well as estimates of background concentrations in sediments for dredged materials where sediment quality information is lacking (see Table 5), it is possible to estimate the total load of selected pollutants in dredged materials by:

$$T = (D \times Q \times C)$$

where:

T = load of pollutant in dredge material (tonnes)
D = weighted average density of dredge materials (tonnes/m^3)
Q = total quantity of dredge materials (m^3)
C = weighted average concentration of contaminant in dredge material (µg/g) or an estimate of the background concentration where no measurement is available.

The total load estimates generated in this manner are conservative. The dredging register probably excludes some of the smaller dredging jobs (<5%). The use of bluff material and non-depositional zone sediment chemical concentrations where the actual dredged sediment chemistry was not available also tends to underestimate loadings.

Table 6 summarizes the estimates of the total pollutant loadings in materials dredged during the 1975-1979 period for each of the Great Lakes basins. Table 7 provides an estimate of the average annual pollutant load in dredged materials for the same period.

Table 8 provides an estimate of total loads of selected pollutants in dredged materials disposed in the aquatic environment during the 1975-1979 period. Table 9 reduces these values to an average annual loading estimate for each basin for water disposed dredged materials.

With large portions (61%) of dredged materials being placed in confined disposal facilities or in upland disposal sites, it is important to examine dredging as a process by which pollutants are removed from the Great Lakes.

Disposal of polluted dredged materials in confined facilities and upland disposal sites has considerably reduced the loads of pollutants transported to the open lakes via dredging. Table 10 summarizes estimates of the pollutant loads removed via dredged materials confinement and out-of-water disposal over the 5-year period covered by the dredging register. Table 11 reduces these values to an estimate of average annual loads on a basin-by-basin basis. Table 12 provides the percent reduction in the potential pollutant loading in each Great Lake due to upland and confined dredge spoil disposal.

TABLE 5

VALUES USED AS BACKGROUND CONCENTRATIONS FOR CALCULATIONS OF POLLUTANT LOADINGS WHEN ACTUAL MEASUREMENTS ARE NOT AVAILABLE (µg/g unless otherwise noted)

	LAKE ONTARIO	LAKE ERIE***	LAKE HURON	LAKE MICHIGAN	LAKE SUPERIOR
PCB**	0.0	0.0	0.0	0.0	0.0
Hg	0.020	0.20	0.023	*0.057	*0.053
Pb	18	17	18	*11	*26
Cu	19	15	18	* 6	*49
Zn	42	46	29	*31	*63
Ni	17	18	15	*13	*72
Cr	18	38	21	*21	*124
Cd	1.5	1.3	1.2	*0.9	*0.8
As	2.6	6.1	4.2	*9.4	*1.3
% Volatile Solids****	1.20	1.52	*1.38	*1.03	*1.41
T.P. (mg/g)	0.567	0.654	0.436	*0.262	*0.524

All values are average bluff concentrations reported by Haras and Thomas (1978) except where indicated.

*Values are average concentrations in sediments of the non-depositional areas of the lakes as reported by Cahill (1981) for Lake Michigan, and the Upper Lakes Reference Group (1977) for Lakes Huron and Superior.

**Assumes no PCBs in sediment as background.

***Includes Lake St. Clair.

****Volatile solids values are based upon estimates of percent organic carbon multiplied by a factor of 1.72 (after Thomas and Mudrock (1979)).

TABLE 6

ESTIMATES OF TOTAL POLLUTANT LOADINGS IN MATERIALS DREDGED FROM 1975-1979 IN EACH OF THE GREAT LAKES (t)

POLLUTANT	BASIN					
	SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	99,664	360,958	164,884	1,383,431	115,114	2,124,052
PCBs	0.27	4.20	3.61	5.42	0.47	13.97
Hg	0.79	2.07	0.53	7.05	0.29	10.72
Pb	48.97	552.70	68.70	1,515.53	107.70	2,293.60
Cu	167.33	145.70	49.42	1,283.28	84.11	1,729.84
Zn	173.89	827.84	439.86	6,592.65	361.40	8,395.64
Ni	86.68	115.84	342.19	1,052.44	73.18	1,670.33
Cr	89.26	250.66	170.62	1,478.14	92.34	2,081.02
Cd	5.26	12.88	16.26	122.79	7.73	164.92
As	4.54	41.26	10.04	238.16	19.02	313.03
Total P	1,229.21	3,621.57	1,674.45	21,866.84	1,905.44	30,297.52

TABLE 7

ESTIMATES OF AVERAGE ANNUAL POLLUTANT LOADINGS IN MATERIALS DREDGED FROM 1975-1979 IN EACH OF THE GREAT LAKES (t)

POLLUTANT	BASIN					
	SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	19,933	72,192	32,977	276,686	23,023	424,810
PCBs	0.05	0.84	0.72	1.08	0.09	2.79
Hg	0.16	0.41	0.11	1.41	0.06	2.14
Pb	9.79	110.54	13.74	303.11	21.54	458.72
Cu	33.47	29.14	9.88	256.66	16.82	345.97
Zn	34.79	165.57	87.97	1,318.53	72.28	1,679.13
Ni	17.34	23.17	68.44	210.49	14.64	334.07
Cr	17.85	50.13	34.12	295.63	18.47	416.20
Cd	1.05	2.58	3.25	24.56	1.55	32.98
As	0.91	8.25	2.01	47.63	3.80	62.61
Total P	245.84	724.31	334.89	4,373.37	381.09	6,059.50

TABLE 8

ESTIMATES OF TOTAL POLLUTANT LOADINGS IN DREDGED MATERIALS AND DISPOSED IN WATER, 1975-1979 (open water dumping, plus beach nourishment) (t)

POLLUTANT	BASIN					
	SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	49,038	60,763	21,985	373,523	65,902	571,213
PCBs	0.04	0.03	0.29	0.80	<0.01	1.16
Hg	0.45	0.62	0.06	3.38	0.20	4.72
Pb	21.41	93.10	21.79	314.86	63.34	514.50
Cu	134.47	50.78	13.08	322.30	54.14	574.77
Zn	96.00	140.89	35.75	1,213.40	239.20	1,725.24
Ni	53.57	61.13	23.34	397.58	40.72	576.35
Cr	46.09	96.43	17.92	374.67	39.84	574.95
Cd	3.25	6.24	1.39	29.40	6.41	46.68
As	2.28	17.18	2.73	55.16	16.29	93.64
Total P	717.26	805.51	268.77	5,250.43	1,294.89	8,341.86

TABLE 9

ESTIMATES OF AVERAGE ANNUAL POLLUTANT LOADINGS IN DREDGED MATERIALS DISPOSED IN WATER, 1975-1979 (open lake dumping and beach nourishment) (t)

POLLUTANT	BASIN					
	SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	9,808	12,153	4,397	74,705	13,180	114,241
PCBs	<0.01	<0.01	0.06	0.16	<0.01	0.23
Hg	0.09	0.12	0.01	0.68	0.04	0.94
Pb	4.28	18.62	4.36	62.97	12.67	102.90
Cu	26.89	10.16	2.62	64.46	10.83	114.95
Zn	19.20	28.18	7.15	242.68	47.84	345.05
Ni	10.71	12.23	4.67	79.52	8.14	115.27
Cr	9.22	19.29	3.58	74.93	7.97	114.99
Cd	0.65	1.25	0.28	5.88	1.28	9.34
As	0.46	3.44	0.55	11.03	3.26	18.73
Total P	143.25	161.10	53.75	1,051.29	258.98	1,668.37

TABLE 10

ESTIMATES OF TOTAL POLLUTANT LOADINGS IN DREDGED MATERIALS DISPOSED OUT OF WATER, 1975-1979 (t)

POLLUTANT	BASIN SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	50,626	300,195	142,899	1,009,908	49,211	1,552,839
PCBs	0.24	4.17	3.31	4.63	0.47	12.82
Hg	0.33	1.45	0.47	3.66	0.09	6.00
Pb	27.56	459.60	46.91	1,200.67	44.36	1,779.10
Cu	32.86	94.92	36.34	960.98	29.97	1,155.07
Zn	77.88	686.95	404.11	5,379.25	122.21	6,670.40
Ni	33.10	54.71	318.85	654.86	32.45	1,093.98
Cr	43.19	154.23	152.70	1,103.47	52.50	1,506.07
Cd	2.01	6.64	14.87	93.39	1.33	118.24
As	2.26	24.09	7.32	183.00	2.73	219.39
Total P	513	2,816	1,406	16,610	611	21,956

TABLE 11

ESTIMATES OF AVERAGE ANNUAL POLLUTANT LOADINGS IN DREDGED MATERIALS DISPOSED OUT OF WATER, 1975-1979 (t)

POLLUTANT	BASIN SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	TOTAL
Volatile Solids	10,125	60,039	28,580	201,982	9,842	310,567
PCBs	0.05	0.83	0.66	0.93	0.09	2.56
Hg	0.07	0.29	0.09	0.73	0.02	1.20
Pb	5.51	91.92	9.38	240.13	8.87	355.82
Cu	6.57	18.98	7.27	192.20	5.99	231.01
Zn	15.58	137.39	80.82	1,075.85	24.44	1,334.08
N	6.62	10.94	63.77	130.97	6.49	218.80
Cr	8.64	30.85	30.54	220.69	10.50	301.21
Cd	0.40	1.33	2.97	18.68	0.27	23.65
As	0.45	4.82	1.46	36.60	0.55	43.88
Total P	102.59	563.21	281.14	3,322.08	122.11	4,390.13

TABLE 12

PERCENT OF ESTIMATED TOTAL DREDGED MATERIALS POLLUTANT LOADINGS PLACED IN CONFINED OR UPLAND DISPOSAL, 1975-1979

POLLUTANT	BASIN					TOTAL GREAT LAKES
	SUPERIOR	MICHIGAN	HURON	ERIE	ONTARIO	
Volatile Solids	51	83	87	73	43	73
PCBs	87	99	92	85	100	92
Hg	42	70	89	52	30	56
Pb	56	83	68	79	41	78
Cu	20	65	73	75	36	67
Zn	45	83	92	82	34	79
Ni	38	47	93	62	44	65
Cr	48	62	90	75	57	72
Cd	38	52	91	76	17	72
As	50	58	73	77	14	70
Total P	42	78	84	76	32	72

TABLE 13

LAKE SUPERIOR ELEMENTAL LOADINGS FROM VARIOUS SOURCES COMPARED WITH ESTIMATED ANNUAL LOADINGS IN DREDGED MATERIALS (t/year)

ELEMENT	TOTAL TRIBUTARY[2]	TOTAL DIRECT MUNICIPAL & INDUSTRIAL[1]	ATMOSPHERIC[2]	TOTAL DREDGED MATERIALS LOAD	WATER DISPOSED DREDGED MATERIALS LOAD
P	2,830	391	800	246	143
Hg	15.5	0.13	0.81	0.16	0.09
Pb	1,106	3.7	650	9.8	4.28
Cd	351	3.3	55	1.1	0.7
Cu	1,015	11.6	369	33.5	26.9
Zn	1,372	65.4	-	34.8	19.2
Cr	792	0.79	-	17.9	9.2
Ni	613	11.2	120	17.3	10.7

[1] IJC (1979).
[2] IJC (1976).

TABLE 14

LAKE MICHIGAN ELEMENTAL LOADINGS FROM VARIOUS SOURCES COMPARED WITH ESTIMATED ANNUAL LOADINGS IN DREDGED MATERIALS (t/year)

ELEMENT	TOTAL DIRECT MUNICIPAL & INDUSTRIAL	SHORE EROSION	ATMOSPHERIC	TOTAL TRIBUTARY	DREDGED MATERIALS	WATER DISPOSED DREDGED MATERIALS
P	1,472[2]	3,700[3]	1,700[3]	2,000[3]	724	161
Hg	-	-	-	-	0.4	0.12
Pb	18.9-23.13[1]	268[1]	1,305[1]	-	110.5	18.6
Cd	6.5[1]	-	43[1]	-	2.6	1.3
Cu	23.4-35.4[1]	-	285[1]	-	29.1	10.2
Zn	110.8-146.7[1]	-	1,769[1]	-	165.6	28.2
Cr	-	-	-	-	50.1	19.3
Ni	-	-	-	-	23.2	12.2
PCB	-	-	7.6[4]	.75[4]	0.84	<0.01

[1] Sullivan et al. (1980).
[2] IJC (1979).
[3] Sonzogni et al. (1979).
[4] Sonzogni et al. (1978).

TABLE 15

LAKE HURON ELEMENTAL LOADINGS FROM VARIOUS SOURCES COMPARED WITH ESTIMATED ANNUAL LOADINGS IN DREDGED MATERIALS (t/year)

ELEMENT	CANADIAN SHORELINE EROSION[1]	TOTAL TRIBUTARY[1]	TOTAL DIRECT MUNICIPAL & INDUST.[4]	ATMOS-PHERIC[2]	ANTHRO-POGENIC LOADING[3]	NATURAL LOADING[3]	TOTAL LOADING[3]	TOTAL DREDGED MATERIALS LOAD	WATER DISPOSED DREDGED MATERIALS LOADING
P	131	3,970	271	620	1,460	3,290	4,750	335	53.8
Hg	.007	4.4	.122		0.34	0.42	0.76	0.11	0.01
Pb	5.3	1,205	8.4	781.6	400	120	520	13.7	4.4
Cd	0.35	796	1.6	79.0	3	5	8	3.3	0.3
Cu	5.2	1,359	14.1	759.7	125	110	235	9.9	2.6
Zn	8.4	1,319	172.8	-	520	275	795	88.0	7.2
Cr	6.0	592	4.8	-	-			34.1	3.6
Ni	4.2	1,479	11.0	210.0	-			68.4	4.7

[1] Thomas and Haras (1978).
[2] IJC (1976).
[3] Kemp and Thomas (1976).
[4] IJC (1979).

TABLE 16

LAKE ERIE ELEMENTAL LOADINGS FROM VARIOUS SOURCES COMPARED WITH ESTIMATED ANNUAL LOADINGS IN DREDGED MATERIALS (t/year)

ELEMENT	CANADIAN SHORELINE EROSION[1]	TOTAL DIRECT MUNICIPAL & INDUSTRIAL[3]	ATMOSPHERIC[4]	ANTHROPOGENIC LOADING[1]	NATURAL LOADING[1]	TOTAL LOADING[1]	TOTAL DREDGED MATERIALS LOAD*	WATER DISPOSED DREDGED MATERIALS LOADING*
P	5,912	6,098	800	5,290	8,793	14,083	4,373	1,051.3
Hg	0.165	-	-	5.7	0.6	6.3	1.41	0.68
Pb	150	-	2,200	889	263	1,152	303.1	63.0
Cd	11	-	150	28	15	43	24.6	5.9
Cu	133	-	330	287	314	601	256.7	64.5
Zn	398	-	-	2,140	1,041	3,181	1,318.5	242.7
Cr	329	-	-	-	-	879	295.6	74.9
Ni	160	-	140	-	-	772	210.5	79.5
As	85	-	-	-	-	12.1[2]	47.6	11.0

[1] Thomas and Haras (1978).
[2] Thomas and Mudroch (1979).
[3] IJC (1979).
[4] Acres Consulting Services (1977).

*Includes Lake St. Clair loadings.

TABLE 17

LAKE ONTARIO ELEMENTAL LOADINGS FROM VARIOUS SOURCES COMPARED WITH ESTIMATED ANNUAL LOADINGS IN DREDGED MATERIALS (t/year)

ELEMENT	CANADIAN SHORELINE EROSION[1]	TOTAL DIRECT MUNICIPAL & INDUSTRIAL[4]	ATMOSPHERIC[2]	ANTHROPOGENIC LOADING[1]	NATURAL LOADING[1]	TOTAL LOADING[1]	TOTAL DREDGED MATERIALS LOAD	WATER DISPOSED DREDGED MATERIALS LOADING
P	777	2,714	480	4,160	3,680	7,840	381	259
Hg	0.028	-	-	11.8	0.8	12.6	0.06	0.04
Pb	26.2	-	280	895	95	990	21.5	12.7
Cd	2.1	-	45	20	4	24	1.6	1.3
Cu	26.7	-	72	290	150	440	16.8	10.8
Zn	60.2	-	-	2,090	380	2,470	72.3	47.8
Cr	26.2	-	-	-	-	264	18.5	8.0
Ni	24.4	-	19	-	-	267	14.6	8.1
As	3.7[3]	-	-	-	-	19.9[3]	3.8	3.3
PCB	-	-	-	-	-	0.35[3]	0.09	<0.01

[1] Thomas & Haras (1978).
[2] Acres Consulting Services (1977).
[3] Thomas & Mudroch (1979).
[4] IJC (1979).

It is recognized that pollutant bioavailability and, thus, the impact of the pollutants, varies widely among the various loading sources. However, for perspective, pollutant loadings from other sources (e.g. atmospheric deposition, municipal and industrial discharges, tributary loadings) have been compared to the annual potential loads in dredged materials (i.e. assuming all dredged materials were dumped in open water) and estimates of the average annual loads of pollutants in dredged materials actually dumped in the aquatic environment for the 1975-1979 period (Tables 13 to 17). It should be noted that, since the loadings for sources other than dredging are derived from various references using differing methodologies and data bases, they may not be additive in a mass balance fashion.

The contribution of selected pollutants to each of the Great Lakes basins is discussed below.

VOLATILE SOLIDS

Of the 86 locations reporting volatile solids the highest average concentrations are found at Knife River Harbor, Minnesota (#63) with 33%; Whitby, Ontario (#18) 18%; and Rouge River, Michigan (#6) 14%. With its overwhelmingly large quantity of dredged materials and relatively high average concentration, Toledo, Ohio has more than twice the total potential load of any other location with over 500,000 t. Other significant loads are found at Cuyahoga River/Cleveland, Ohio (234,000 tonnes), Saginaw R., Michigan (148,000) and Green Bay Harbor, Wisconsin (133,000).

The 86 locations reporting volatile solid analyses represent 94% of the volume dredged in the Great Lakes during the register period. The 6% of the dredged materials without measured volatile solids concentrations were given, for the purpose of calculating an estimate of the total volatile solids burden, an appropriate background concentration from Table 5. This 6% accounts for 1.5% of the total estimated volatile solids loading in Great Lakes dredged materials. The total estimated volatile solid loadings (t) to the Great Lakes by basin and country is:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	83,132	16,532	99,664
Michigan	360,958	-	360,958
Huron	152,884	12,000	164,884
Erie	1,345,408	38,023	1,383,431
Ontario	61,135	53,979	115,114
TOTAL	2,003,517	120,535	2,124,052

An estimate of the burden of the volatile solids in the dredged materials disposed of in the aquatic environment has been compiled by adding the volatile solids loading associated with dredged materials dumped in open water with that used for beach nourishment. Basin and country estimates for in-water dumped materials are summarized below:

VOLATILE SOLIDS (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	34,467	14,571	49,038
Michigan	60,763	-	60,763
Huron	11,333	10,652	21,985
Erie	369,524	3,999	373,523
Ontario	60,275	5,627	65,902
TOTAL	536,362	34,850	571,213

Estimates of the volatile solid load in dredge material removed from the aquatic environment and placed in confined disposal facilities or upland disposal sites are summarized by country for each Great Lakes basin below:

VOLATILE SOLIDS (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	48,665	1,961	50,626
Michigan	300,194	-	300,194
Huron	141,551	1,348	142,899
Erie	975,884	34,024	1,009,908
Ontario	860	48,351	49,211
TOTAL	1,467,155	85,684	1,552,839

TOTAL PHOSPHORUS (P)

Of the 71 locations reporting total P, the highest average concentrations were found at Michigan City Harbor, Indiana (#21) 3.7 mg/g; Wheatley, Ontario (#25) 2.3; and Lorain, Ohio (#1) 2.2. The largest total loads were calculated to be at Cuyahoga River/Cleveland, Ohio (6,300 t) and Toledo, Ohio (5,800 t). These two locations alone account for 40% of the total load in Great Lakes dredged materials.

The 71 locations reporting actual sediment analyses for total phosphorus represent 84.5% of the materials dredged in the Great Lakes during the 1975-1979 period. The 15.2% of dredged materials for which sediment analysis is unavailable were given the appropriate background concentration from Table 5 and account for 8.6% of the total Great Lakes dredged materials total P load.

The total phosphorus load (t) in Great Lakes dredged materials by basin and country is:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	808	422	1,229
Michigan	3,622	-	3,622
Huron	1,489	186	1,674
Erie	20,928	939	21,867
Ontario	1,149	756	1,905
TOTAL	27,995	2,302	30,298

Basin estimates for phosphorus loadings in dredged materials placed in water are summarized by country below:

PHOSPHORUS (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	367	349	716
Michigan	806	-	806
Huron	102	167	269
Erie	5,154	102	5,256
Ontario	1,142	153	1,295
TOTAL	7,572	770	8,342

Basin estimates for P disposed of out of the aquatic environment are summarized by country below:

PHOSPHORUS (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	440	73	513
Michigan	2,816	-	2,816
Huron	1,387	19	1,406
Erie	15,773	837	16,610
Ontario	7	603	611
TOTAL	20,424	1,532	21,956

Lake Superior phosphorus loads in water disposed dredged materials are 37% as large as the direct municipal-industrial loadings. The total potential load in dredged materials (if all dredged materials were disposed in water) is about 63% of the direct municipal-industrial loading. In comparison with atmospheric loading and tributary loading, water disposed dredged materials loadings are small, 5 and 18%, respectively (see Table 13).

Comparing the loading to Lake Michigan, if all dredged materials were placed in aquatic disposal, we see that dredging would be smaller than shore erosion (20%), tributary loading (36%), atmospheric loading (43%), and direct municipal and industrial discharges (49%). The phosphorus loads in dredged material disposed in water are small: 11% as large as direct municipal and industrial discharge, 9% of atmospheric loadings, 8% of tributary loading, and 4% the size of shore erosion loading (see Table 14).

Phosphorus in dredged materials disposed in water in Lake Huron represent a load only 1% as large as total tributary loadings, 20% of industrial and municipal loads and 9% of atmospheric loading (see Table 15). However, total potential loads in dredged materials in Lake Huron exceed those from municipal and industrial discharges and are about 50% as large as atmospheric loadings.

Lake Erie water disposed dredged materials average annual loading of phosphorus exceeds atmospheric inputs but is less than 20% of direct municipal and industrial discharges. Total potential dredged materials load is almost as great as the municipal and industrial loading to the lake and is more than four times the available estimates for annual atmospheric loading to Lake Erie (Table 16).

Water disposed dredged materials contributed average annual loadings greater than 54% the size of atmospheric loadings during the 1975-1979 period to Lake Ontario. Direct loads in water disposed dredged materials were much smaller than direct municipal and industrial loadings (<10%). Total potential dredged material loading is nearly equal to atmospheric loading (80%) and is about 50% of the Canadian shoreline erosion loading, although it represents only a small (14%) loading in relation to direct municipal-industrial loading (see Table 17).

It is apparent that for all of the Great Lakes, dredged materials disposal in water is a significant though not dominant loading, and confined and upland disposal of dredged materials has markedly reduced the total phosphorus inputs to the lakes.

POLYCHLORINATED BIPHENYLS (PCBS)

Of the 21 locations reporting PCBs, the highest average concentrations are found at Ogdensburg, New York (#5) 7 µg/g, Green Bay Harbor, Wisconsin (#2) 3.7 µg/g; Ashtabula, Ohio (#4) 3.6 µg/g, Duluth-Superior, Minnesota-Wisconsin (#6) 2.4 µg/g and Saginaw R., Michigan (#3) 2.2 µg/g. The largest total potential loads were calculated to be at Cuyahoga River/Cleveland, Ohio - 4.5 t; Green Bay Harbor, Wisconsin - 4.2 t and Saginaw R., Michigan - 3.5 t. These three locations account for 88% of the total load from Great Lakes dredged materials.

The 21 locations reporting actual PCB sediment analysis represent 25.4% of the total dredged materials moved in the Great Lakes during the register period. The 74.6% of dredged materials for which no analysis is available was assumed to have no PCB content in calculating total potential loads.

The total potential load (1975-1979) (t) to the Great Lakes by basin and country is:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.27	<0.01	0.27
Michigan	4.20	0.00	4.20
Huron	3.61	<0.01	3.61
Erie	5.41	<0.01	5.42
Ontario	0.29	0.17	0.47
TOTAL	13.78	0.19	13.97

The direct load (1975-1979) (t) to the Great Lakes by basin and country is:

PCB (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.03	<0.01	0.04
Michigan	0.03	-	0.03
Huron	0.29	<0.01	0.29
Erie	0.80	<0.01	0.80
Ontario	<0.01	<0.01	<0.01
TOTAL	1.15	0.01	1.16

An estimate of PCB load in dredged materials placed in confined disposal facilities or upland disposal sites is summarized by country for each Great Lake basin below:

PCB (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.24	<0.01	0.24
Michigan	4.17	-	4.17
Huron	3.31	<0.01	3.31
Erie	4.62	0.01	4.63
Ontario	0.29	0.17	0.47
TOTAL	12.63	0.18	12.82

MERCURY (HG)

Of the 69 locations reporting mercury, the highest average concentrations are found in the Detroit River Channels, Michigan (#10) 1.2 µg/g; Chenal Ecarte, Ontario (#27) 1.1 µg/g; Ashtabula Harbor, Ohio (#3) 1.1 µg/g and Kenosha Harbor, Wisconsin (#16) 1.0 µg/g.

The largest load was found at Toledo, Ohio 1.8 t, which represents 16.8% of the total load in all dredged materials moved during the 1975-1979 period. The Lake Erie Sailing Course, Michigan and Ohio was second with 1.5 t. Ashtabula, Ohio and Green Bay, Wisconsin each contained 0.8 t of mercury. These four locations account for almost one-half of the total mercury load in materials dredged during the 1975-1979 period.

The 69 locations reporting mercury analyses represent 80.3% of the materials dredged in the Great Lakes during the study period. The 19.7% of the materials for which no analytical data were available was given a background concentration taken from Table 5 in order to make an estimate of total load of mercury in Great Lakes dredged materials. This correction procedure accounts for 0.41% of the estimate of total load in Great Lakes dredged materials during 1975-1979.

The total load (t) of mercury in dredged materials for the Great Lakes by country and basin (1975-1979) is:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.66	0.13	0.79
Michigan	2.07	-	2.07
Huron	0.51	0.02	0.53
Erie	6.80	0.24	7.05
Ontario	0.20	0.09	0.29
TOTAL	10.24	0.48	10.72

Basin estimates of mercury load to the aquatic environment are presented below by country:

MERCURY (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.34	0.12	0.45
Michigan	0.62	-	0.62
Huron	0.04	0.02	0.06
Erie	3.37	0.01	3.38
Ontario	0.18	0.02	0.20
TOTAL	4.55	0.17	4.72

An estimate of mercury load in dredged materials placed in confined disposal facilities or upland disposal sites is summarized by country for each Great Lake basin below:

MERCURY (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	0.32	0.01	0.33
Michigan	1.45	-	1.45
Huron	0.47	<0.01	0.47
Erie	3.43	0.23	3.66
Ontario	0.02	0.07	0.09
TOTAL	5.69	0.31	6.00

The mercury load to Lake Superior from water disposal of dredged materials is similar to that from municipal and industrial discharges. In comparison to tributary or atmospheric inputs, however, the dredged materials loads are small (12% of the atmospheric load and 0.6% of tributary loads). The total potential dredged materials mercury load to Lake Superior exceeds municipal and industrial loadings but does not approach the magnitude of tributary loading and represents a load less than 20% the size of atmospheric inputs (See Table 13).

The mercury load to Lake Huron from water disposal of dredged materials represents less than 1.5% of the estimated average annual load to the lake and is much smaller than the direct municipal-industrial loadings or tributary loadings (see Table 15). The total potential dredged materials mercury load exceeds loadings from Canadian shoreline erosion and approaches the loading from total direct municipal and industrial discharges but constitutes only a small proportion (<15%) of the estimated total lake loading.

The mercury load to Lake Erie from water disposal of dredged materials represents 10% of the estimated total average annual mercury loading to the lake (see Table 16) and exceeds (four times) estimated Canadian shoreline erosion loadings. The total potential dredged materials mercury load is about 20% of the estimated total mercury load received by Lake Erie.

The mercury load to Lake Ontario from water disposal of dredged materials represents about 0.3% of the total annual estimated mercury load (see Table 17) but exceeds the estimated loading from Canadian shoreline erosion. The total potential dredged materials mercury load is only about 0.5% of the estimated total mercury load received by Lake Ontario.

LEAD (PB)

Of the 70 locations reporting lead values, the highest average concentrations are found at Rouge River, Michigan (#4) 339 μg/g; Milwaukee, Wisconsin (#2) 304 μg/g, and Michigan City, Indiana (#18) 217 μg/g. The largest total load was calculated for Cuyahoga River/Cleveland, Ohio - 579 t - which represents 25% of the total load in all materials dredged during the 1975-1979 period in the Great Lakes Basin. Similarly, Milwaukee, Wisconsin accounts for 257 t (11%), Toledo, Ohio, 252 t (11%); Rouge River, Michigan 194 t (8.5%) and Green Bay, Wisconsin 135 t (6%). These five locations account for about 62% of the lead load measured in the total Great Lakes dredged materials load.

The 70 locations reporting lead values represent 88.4% of the total materials dredged during the study period. The 11.6% of dredged materials for which sediment analysis was unavailable was given appropriate background concentrations from Table 5 and this accounts for 2.88% of the total lead load (t) reported by basin below:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	39.58	9.38	48.97
Michigan	552.70	-	552.70
Huron	50.33	18.37	68.70
Erie	1,474.10	41.42	1,515.53
Ontario	62.81	44.89	107.70
TOTAL	2,179.52	114.08	2,293.60

The direct load (t) to the Great Lakes by basin from dredging disposed in open water dumping operations and beach nourishment projects is summarized below:

LEAD (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	15.64	5.76	21.41
Michigan	93.10	-	93.10
Huron	4.95	16.84	21.79
Erie	307.74	7.12	314.86
Ontario	59.10	4.24	63.34
TOTAL	480.54	33.96	514.50

The potential lead load (t) removed from the Great Lakes through dredged materials disposal in confined facilities or upland disposal is summarized below:

LEAD (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	23.94	3.62	27.56
Michigan	459.60	-	459.60
Huron	45.38	1.53	46.91
Erie	1,166.36	34.31	1,200.67
Ontario	3.71	40.65	44.36
TOTAL	1,698.98	80.11	1,779.10

The lead load to Lake Superior from water disposal of dredged materials is slightly greater than loading from direct municipal and industrial discharges but only 0.7% of tributary and 0.4% of atmospheric inputs. The total potential dredged materials lead load to Lake Superior exceeds municipal and industrial but does not approach the magnitude of tributary or atmospheric inputs (see Table 13).

The lead load to Lake Michigan from water disposal of dredged materials is about equal to loadings from total direct municipal/industrial discharges but small in comparison with shore erosion inputs (about 7% the size) and atmospheric loadings (about 1% as large). The total potential dredged materials lead loading is about four times the loading from direct municipal/industrial sources and is about 41% as large as shore erosion inputs and about 8% as large as atmospheric loadings.

The lead load to Lake Huron from water disposal of dredged materials is only about 0.8% of the estimated total lead loading to Lake Huron (see Table 15). This is about 83% as large as loading from Canadian shoreline erosion, about 50% as large as direct municipal/industrial loading, about 0.6% as large as atmospheric loading, and about 4% as large total tributary loadings. Total potential dredged materials lead loads is only 3% of the estimated total loading to Lake Huron.

The lead load to Lake Erie from water disposal of dredged materials represents 6% of the total estimated annual lead loading to the lake. This load is about 3% of the size of atmospheric loading and 42% the size of Canadian shoreline erosion inputs. The total potential dredged materials lead load is about 27% of the estimated total lead load to the lake. This is about 14% the size of atmospheric inputs and twice the size of Canadian shore erosion loads.

The lead load to Lake Ontario from water disposal of dredged materials represents only about 1% of the estimated total lead load received by the lake. It is small in comparison to atmospheric loads (about 5% as large) and Canadian shoreline erosion inputs (about half as large). The total potential dredged materials lead load is only 2% of the estimated total Lake Ontario loading (see Table 17).

ARSENIC (AS)

Of the 51 locations reporting arsenic concentrations, the highest average concentrations are found at Cuyahoga River/Cleveland, Ohio (#1) 33.0 µg/g; Lorain, Ohio (#13) 14.9 µg/g; Fairport, Ohio (#7) 13.9 µg/g; Vermilion, Ohio (#23) 12.9 µg/g; and Rocky River, Ohio (#27) 12.0 µg/g. The largest loads were calculated to be at Cuyahoga River/Cleveland, Ohio - 103 t which represents about 33% of the total load in materials dredged in the Great Lakes. Other notable locations with large arsenic loadings include Toledo, Ohio with 41 t or 13% of the arsenic in Great Lakes dredged materials and Rochester, New York with 13 t or 4% of the total dredged materials load. These three locations account for 50% of the total arsenic load measured in dredged materials in the Great Lakes from 1975-1979.

The 51 dredging locations for which actual analytical data exist account for 76% of the dredged materials recorded in the dredging register. The 24% of Great Lakes dredged materials for which no data are available have been given a background arsenic concentration based on the background values in Table 5 and account for 17% of the total estimate of arsenic loading (t) in Great Lakes dredged materials recorded below:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	3.70	0.85	4.54
Michigan	41.26	-	41.26
Huron	7.85	2.19	10.04
Erie	232.24	5.92	238.16
Ontario	15.97	3.04	19.02
TOTAL	301.03	12.00	313.03

Estimates of the arsenic load in dredged materials disposed of in the aquatic environment of each of the Great Lakes are summarized below:

TOTAL ARSENIC (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT

BASIN	UNITED STATES	CANADA	TOTAL
Superior	1.62	0.67	2.28
Michigan	17.18	-	17.18
Huron	0.85	1.88	2.73
Erie	54.51	0.66	55.16
Ontario	15.68	0.61	16.29
TOTAL	89.82	3.82	93.64

The arsenic loading (t) removed from the aquatic environment and placed in a confined disposal facility or upland disposal site is summarized below:

TOTAL ARSENIC (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT

BASIN	UNITED STATES	CANADA	TOTAL
Superior	2.08	0.18	2.26
Michigan	24.09	-	24.09
Huron	7.00	0.31	7.32
Erie	177.74	5.26	183.00
Ontario	0.29	2.43	2.73
TOTAL	211.20	8.18	219.39

CADMIUM (CD)

Of the 49 locations reporting cadmium analyses, the highest averages were found at Michigan City, Indiana (#22) with 59 µg/g; Lorain Harbor, Ohio (#4) with 22 µg/g; and Cuyahoga River/Cleveland, Ohio (#1) with 15 µg/g.

The largest total load was calculated for Cuyahoga River/Cleveland, Ohio with 45 t of Cd representing 27% of the total Great Lakes dredged materials load. Toledo, Ohio accounts for 30 t or 18% of the total load and Saginaw R., Michigan accounts for 15 t. In total, these three locations are responsible for 55% of the total dredged materials load of Cd for the five-year record of the dredging register.

The 49 locations for which actual analytical data appear in the dredging register account for 77% of the dredged volume recorded. The 24% of the Great Lakes dredged materials for which no measured concentrations were available have been given background cadmium concentrations from Table 5. This accounts for only 5% of the total Great Lakes dredged materials loading of Cd recorded below.

BASIN	UNITED STATES	CANADA	TOTAL
Superior	4.85	0.41	5.26
Michigan	12.88	-	12.88
Huron	15.63	0.63	16.26
Erie	120.02	2.77	122.79
Ontario	6.17	1.56	7.73
TOTAL	159.56	5.36	164.92

Estimates of the load of cadmium in dredged materials disposed of in the aquatic environment of the Great Lakes are summarized below:

TOTAL CADMIUM (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	2.95	0.30	3.25
Michigan	6.24		6.24
Huron	0.85	0.54	1.39
Erie	29.17	0.23	29.40
Ontario	6.05	0.35	6.41
TOTAL	45.26	1.42	46.68

Estimates of cadmium loading (t) removed from the aquatic environment and placed in a confined disposal facilities or upland disposal site are summarized for each basin below:

TOTAL CADMIUM (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	1.90	0.11	2.01
Michigan	6.64	-	6.64
Huron	14.78	0.09	14.87
Erie	90.85	2.54	93.39
Ontario	0.12	1.21	1.33
TOTAL	114.30	3.95	118.24

The cadmium load to Lake Superior from water disposal of dredged materials is only 21% of the load from direct municipal and industrial discharges and, in comparison to atmospheric or tributary cadmium loading, the dredged materials loadings are small (0.2% the size of tributary loads and 1.3% the size of atmospheric loadings). The total potential dredged materials load to Lake Superior reflects a similar pattern as there is little difference between water disposed dredged material cadmium loads and total potential dredged materials loads (see Table 13).

The cadmium load to Lake Michigan from water disposal of dredged materials is only 20% as large as the load from direct municipal and industrial discharges and only 3% as large as the atmospheric loading to the lake. Total potential dredged materials load to Lake Michigan is less than direct municipal and industrial loading (about 40% as large) and only 6% as large as atmospheric inputs (see Table 14).

The cadmium load to Lake Huron from water disposal of dredged materials is only a small portion of the total estimated cadmium load (3.8%). It is also much smaller than tributary loading, direct municipal and industrial loading, or atmospheric loading (0.04%, 18.8%, and 0.38%, respectively). The total potential dredged materials load is a significant portion of the total lake loading (41%). It is nearly 10 times the size of Canadian shoreline erosion inputs and is twice the size of municipal and industrial direct discharges. It is, however, only a small fraction of atmospheric loads (4%) and total tributary loadings (0.4%).

The cadmium load to Lake Erie from water disposal of dredged materials is a significant portion (13%) of the total estimated annual lake cadmium loading. This load is about half the size of the load from Canadian shoreline erosion and about 4% the size of atmospheric cadmium loadings to the lake. The total potential dredged materials cadmium load is about 56% of the estimated total lake loading, about 16% of the magnitude of atmospheric inputs and over twice the size of Canadian shoreline erosion cadmium loadings.

The cadmium load to Lake Ontario from water disposal of dredged materials represents about 5% of the estimated total lake load. It is small in comparison to atmospheric loads (about 3% the size) but is over 60% the size of Canadian shoreline erosion loads. The total potential dredged materials cadmium load is similar in size to the water disposed dredged materials load (see Table 17).

COPPER (CU)

Of the 53 locations reporting copper analyses, the highest average concentrations were found at Lac Labelle, Michigan (#24) 1,118 µg/g; Keweenaw Waterway, Michigan (#7) 711 µg/g; Lorain, Ohio (#6) 244 µg/g; and Monroe, Michigan (#2) 228 µg/g.

The largest total load, 338 t, was associated with Cuyahoga River - Cleveland, Ohio dredging (20% of total estimated Great Lakes dredged materials load). Large loads were associated with dredging at Monroe, Michigan - 210 t (12% of total load); Toledo, Ohio - 176 t (10% of total load); and Rouge River, Michigan - 107 t (6% of total load). These four locations account for 48% of the total copper load in materials dredged during 1975-1979.

The 53 locations reporting copper analyses in the dredging register account for 78% of materials dredged in the Great Lakes from 1975-1979. The 22% of Great Lakes dredged materials for which no measured copper concentrations were available were given background concentrations in the calculation of total dredged materials loads and accounts for 6% of the estimated total Great Lakes dredged materials copper load.

Estimates for total 1975-1979 dredged materials load (t) of copper in the Great Lakes by basin are:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	142.72	24.61	167.33
Michigan	145.70	-	145.70
Huron	40.01	9.40	49.42
Erie	1,257.83	25.45	1,283.28
Ontario	51.77	32.34	84.11
TOTAL	1,638.02	91.81	1,729.84

Basin estimates for copper loads in materials placed in the aquatic environment are summarized below:

TOTAL COPPER (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	26.03	6.82	32.86
Michigan	94.92	-	94.92
Huron	35.00	1.34	36.34
Erie	939.31	21.66	960.98
Ontario	2.11	27.86	29.97
TOTAL	1,097.37	57.69	1,155.07

An estimate of the copper burden in dredged materials removed from the aquatic environment and placed in confined disposal facilities or upland disposal sites is summarized for each Great Lakes basin below:

TOTAL COPPER (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	116.68	17.79	134.47
Michigan	50.78	-	50.78
Huron	5.02	8.06	13.08
Erie	318.51	3.79	322.30
Ontario	49.66	4.48	54.14
TOTAL	540.65	34.12	574.77

The copper load to Lake Superior from water disposal of dredged materials is two times the loading from direct municipal and industrial discharges. In comparison to tributary and atmospheric copper inputs, the dredged materials loads are small (3% and 7%, respectively). The total potential dredged materials copper load to Lake Superior is three times the loading from direct municipal and industrial discharges, 3% the size of total tributary loading and 9% the size of atmospheric loading (see Table 13).

The copper load to Lake Michigan from water disposal of dredged materials is about equal to that of direct municipal and industrial discharges, however, it is only about 4% the size of atmospheric loadings. The total potential dredged materials copper load to Lake Michigan is about equal to the loading from direct municipal and industrial discharges, but is only about 10% the size of atmospheric loading (see Table 14).

The copper load to Lake Huron from water disposal of dredged materials is only 1% of the total Lake Huron loading (see Table 15). In comparison to atmospheric loading and total tributary loadings, it is also very small (0.3% the size of atmospheric load and 0.2% the size of tributary loading). In comparison to Canadian shoreline erosion and direct municipal and industrial discharge loads, the water disposed dredged materials load is somewhat more significant (50% the size of shoreline erosion loading and 18% the size of municipal and industrial loads). The total potential dredged material copper load to Lake Huron is twice the Canadian shoreline erosion loading, 70% the size of direct municipal-industrial loadings, only 1% as large as the atmospheric loading, and 0.7% as large as the tributary loading (see Table 15).

The copper load to Lake Erie from water disposal of dredged materials represents about 11% of the total estimated annual copper load. This load is about 19% the size of atmospheric copper loading and about 48% the size of Canadian shoreline erosion loading. The total potential dredged materials copper load is about 43% of the total annual load to the lake, 79% the size of atmospheric loads and about two times the size of Canadian shoreline erosion loadings (see Table 16).

The copper load to Lake Ontario from water disposal of dredged materials is only about 2% of the total estimated copper load. It is small in comparison to atmospheric loads (15% as large) and Canadian shoreline erosion (40% as large). The total potential dredged materials copper load is only 4% of the total estimated load to Lake Ontario.

ZINC (ZN)

Analytical determinations for zinc are reported in the dredging register for 68 locations. The highest average concentrations are reported for Michigan City, Indiana (#13) with 1,664 µg/g; Rouge River, Michigan (#3) with 1,197 µg/g; Cuyahoga River/Cleveland, Ohio (#1) with 1,046 µg/g; Lorain, Ohio (#6) with 962 µg/g; and Ogdensburg, New York (#23) with 866 µg/g.

The largest zinc load was associated with Cuyahoga River/Cleveland, Ohio dredged materials which has been estimated to have 3,246 tonnes of zinc for the five-year period of the dredging register. This is estimated to be about

39% of the total Great Lakes dredged materials zinc burden for the 1975-1979 period. High zinc loads have also been associated with dredged materials from Toledo, Ohio and Rouge River, Michigan with 734 t and 684 t, respectively. These three locations alone account for about 56% of the total Great Lakes dredged materials load of zinc.

The 68 locations reporting zinc analyses in the dredging register account for 88% of the materials dredged in the Great Lakes from 1975-1979. The 12% of the Great Lakes dredged materials for which no measured zinc concentrations were available were given, for purposes of calculating an estimate of total zinc load in Great Lakes dredged materials, background concentrations of zinc associated with the appropriate basin. This 12% of dredged materials accounts for 2% of the total estimated zinc burden for the Great Lakes.

Estimates for the 1975-1979 dredged materials burden (t) of zinc in the Great Lakes by basin and country are:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	109.64	64.25	173.89
Michigan	827.84	-	827.84
Huron	424.55	15.31	439.86
Erie	6,508.00	84.65	6,592.65
Ontario	265.79	95.62	361.40
TOTAL	8,135.81	259.83	8,395.64

Basin estimates for zinc in aquatic disposed dredged materials are summarized below:

TOTAL ZINC (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	69.11	8.77	77.88
Michigan	686.95		686.95
Huron	401.72	2.39	404.11
Erie	5,305.32	73.93	5,379.25
Ontario	36.49	85.71	122.21
TOTAL	6,499.59	170.80	6,670.40

An estimate of the zinc loads (t) in dredged materials removed from the aquatic environment and placed in confined disposal facilities or upland disposal sites is summarized for each Great Lakes basin below:

TOTAL ZINC (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	40.53	55.48	96.00
Michigan	140.89	-	140.89
Huron	22.83	12.92	35.75
Erie	1,202.68	10.72	1,213.40
Ontario	229.29	9.90	239.20
TOTAL	1,636.22	89.02	1,725.24

The zinc load to Lake Superior from water disposal of dredged materials is small in comparison to loading estimates from other sources (See Table 17). The total potential dredged materials zinc load to Lake Superior is 53% of direct municipal and industrial loading, and 3% of total tributary loadings.

The zinc load to Lake Michigan from water disposal of dredged materials is only 2% of atmospheric loading and 25% as large as direct municipal and industrial discharge loading. The total potential dredged materials zinc load to Lake Michigan is also small in comparison to atmospheric loading (9.4%) but is about equal to the direct municipal/industrial discharge loading.

The zinc load to Lake Huron from water disposal of dredged materials is about the same as that from Canadian shore erosion but is much smaller than direct municipal/industrial discharge loading. It is only about 1% of the total Lake Huron zinc loading. The potential dredged materials load is 10 times the Canadian shoreline erosion loading of zinc but is only 50% as large as direct municipal/industrial loading, 7% as large as tributary loading and represents about 11% of the total Lake Huron zinc loading (see Table 15).

The zinc load to Lake Erie from water disposal of dredged materials is only 8% of the total Lake Erie load. This load is about 60% the size of loading from Canadian shore erosion. Total potential dredged materials load is 42% of the total Lake Erie zinc loading and is about three times the load contributed from Canadian shoreline erosion (see Table 10).

The zinc load to Lake Ontario from water disposal of dredged materials is about 2% of the total estimated loading to the lake. This load is about 80% of the Canadian shoreline erosion loading. Total potential dredged materials loading is about 2% of the total estimated loading to the lake. This load is about equal to the loading from Canadian shoreline erosion (see Table 17).

NICKEL (NI)

Nickel analyses are reported for 50 locations in the dredging register with the highest average concentrations found at Saginaw R., Michigan (#1) with 204 µg/g; Michigan City, Indiana (#29) with 142 µg/g; Conneaut, Ohio (#4) with 137 µg/g; and Ashtabula, Ohio (#6) with 110 µg/g.

The largest nickel loads were associated with dredged materials from Saginaw R., Michigan; Toledo, Ohio; and Cuyahoga River/Cleveland, Ohio with 331 t, 219 t and 213 t, respectively. These three locations account for 46% of the total nickel load in materials dredged in the Great Lakes for the 1975-1979 period.

The 50 locations reporting nickel analyses in the dredging register account for about 77% of the materials dredged in the Great Lakes during the register period. The 23% of the dredged materials without measured nickel concentrations were given, for the purpose of calculating an estimate of the total nickel load in Great Lakes dredged materials, background concentrations of nickel (see Table 5). This 23% of dredged materials accounts for about 9% of the estimated nickel load summarized by basin and country below:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	58.19	28.49	86.68
Michigan	115.84	-	115.84
Huron	334.35	7.84	342.19
Erie	1,030.26	22.18	1,052.44
Ontario	38.36	34.82	73.18
TOTAL	1,577.01	93.32	1,670.33

Basin estimates for nickel loads in materials placed in water are summarized below:

TOTAL NICKEL (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	23.08	10.03	33.10
Michigan	54.71	-	54.71
Huron	317.73	1.12	318.85
Erie	635.03	19.83	654.86
Ontario	1.64	30.81	32.45
TOTAL	1,032.19	61.79	1,093.98

Estimates of nickel load (t) in dredged materials removed from the aquatic environment and placed in confined disposal facilities or upland disposal sites are summarized for each Great Lakes basin below:

TOTAL NICKEL (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	35.11	18.46	53.57
Michigan	61.13	-	61.13
Huron	16.62	6.72	23.34
Erie	395.23	2.35	397.58
Ontario	36.72	4.01	40.72
TOTAL	544.81	31.53	576.35

The nickel load to Lake Superior from water disposal of dredged materials is about the same as loading from direct municipal and industrial discharges but is only a small fraction of the loadings from tributary sources and from atmospheric deposition (see Table 13). The total potential dredged materials nickel load to Lake Superior is 3% of tributary loadings, 14% of atmospheric loading, and 1.5 times as large as direct municipal and industrial discharges.

The nickel load to Lake Huron from water disposal of dredged materials is about the same as loading from Canadian shoreline erosion. It is 0.3% of total tributary loading, 2% of atmospheric loading and 42% of direct municipal/industrial loading. The total potential dredged materials load to Lake Huron is 16 times the Canadian shoreline erosion load, and six times the total direct municipal/industrial loading. It is only 32% as large as atmospheric loading and 5% as large as tributary loading (see Table 15).

The nickel load to Lake Erie from water disposal of dredged materials is about 10% of the total nickel load to the lake. This load is about 60% as large as atmospheric loadings of nickel to Lake Erie, and about 50% as large as the load contributed to the lake by Canadian shoreline erosion. Total potential dredged materials load is about 28% of the total lake loading, about 1.3 times the load from Canadian shoreline erosion, and is 15 times the load from atmospheric deposition (see Table 16).

The nickel load to Lake Ontario from water disposal of dredged materials is about 3% of the estimated total load to the lake. This load is about 34% as large as the loading from Canadian shoreline erosion and 43% as large as the load from atmospheric deposition. Total potential dredged materials load is about 5% of the estimated total lake nickel load. This is 60% of the load from Canadian shore erosion and about 77% as large as atmospheric loading.

CHROMIUM (CR)

Analytical results for chromium determination are reported for 52 locations in the dredging register with the highest average concentrations found at Michigan City, Indiana (#24) with 281 µg/g; Monroe, Michigan (#4) with 159 µg/g; Grand Haven, Michigan (#7) and Rouge River, Michigan (#6) both with 157 µg/g; and Whitby, Ontario (#16) with 155 µg/g.

The largest chromium burdens were associated with dredged materials from Toledo, Ohio, and Cuyahoga River/Cleveland, Ohio with 374 t and 334 t of chromium, respectively. These two locations account for 34% of the Great Lakes dredged materials chromium burden. High chromium burdens were also calculated for Saginaw R., Michigan; Monroe, Michigan; and Green, Bay, Wisconsin with 155, 147 and 106 t of chromium, respectively.

The 52 locations reporting chromium analyses in the dredging register account for about 76% of the materials dredged in the Great Lakes from 1975-1979. The 24% of dredged materials without measured chromium concentrations were given, for the purpose of calculating an estimate of total chromium burden in Great Lakes dredged materials, background concentrations of chromium (see Table 5). This 24% of dredged materials accounts for about 14% of the estimated chromium load in Great Lakes dredged materials. An estimate for the 1975-1979 dredged materials burden (t) of chromium in the Great Lakes by basin and country is summarized below:

BASIN	UNITED STATES	CANADA	TOTAL
Superior	58.57	30.69	89.26
Michigan	250.66	-	250.66
Huron	159.64	10.97	170.62
Erie	1,430.30	47.84	1,478.14
Ontario	37.15	55.19	92.34
TOTAL	1,936.33	144.69	2,081.02

Basin estimates for chromium loading in dredged materials disposed of in water are summarized below:

TOTAL CHROMIUM (t) DISPOSED OF OUT OF THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	25.90	17.27	43.18
Michigan	154.23	-	154.23
Huron	151.13	1.57	152.70
Erie	1,061.61	41.86	1,103.47
Ontario	1.56	50.95	52.50
TOTAL	1,394.43	111.64	1,506.07

An estimate of chromium load (t) in dredged materials placed in confined disposal facilities or upland disposal sites is summarized for each Great Lakes basin below:

TOTAL CHROMIUM (t) DISPOSED OF IN THE AQUATIC ENVIRONMENT			
BASIN	UNITED STATES	CANADA	TOTAL
Superior	32.67	13.42	46.09
Michigan	96.43		96.43
Huron	8.51	9.40	17.92
Erie	368.70	5.98	374.67
Ontario	35.60	4.24	39.84
TOTAL	541.90	33.05	574.95

The chromium load to Lake Superior from water disposal of dredged materials is 1% of total tributary sources, however, dredged materials disposal loading is 12 times greater than direct industrial/municipal inputs. Total potential dredged materials chromium load to Lake Superior compares in a similar manner to both municipal/industrial loading and tributary loading.

The chromium load to Lake Huron from water disposal of dredged materials is about 60% of Canadian shoreline erosion loading, about 75% of direct municipal/industrial discharge loading but only 0.6% of total tributary loadings. Total potential dredged materials load is six times the Canadian shoreline erosion loading, about seven times the direct municipal/industrial discharge loading but only 6% of the size of tributary loading to Lake Huron.

The chromium load to Lake Erie from water disposal of dredged materials is about 9% of the estimated total lake loading. This load is about 23% as large as the load contributed by Canadian shoreline erosion. Total potential dredged materials loading is about 35% of the estimated total lake chromium loading and is about equal to the load from Canadian shoreline erosion.

The chromium load to Lake Ontario from water disposal of dredged materials is 3% of the total estimated lake chromium loading. This is about 30% as large as loading from Canadian shore erosion. The total potential dredged materials chromium loading is about 7% of the total estimated lake chromium which is about 71% as large as the loading from canadian shoreline erosion.

DESIGNATION OF POTENTIAL PROBLEM AREAS

Since 1975 and in accordance with recommendations of the International Work Group, site specific evaluations have been made on dredging projects. These evaluations have involved considerations relating to the dredge site, method of dredging, quantity and quality of dredged materials, means of disposal and schedule of operations. The decision on the ultimate disposition of the dredged materials relies heavily on the physical and chemical characterization of the sediment. Although most of the information required for such evaluations is contained in the register, it would not be practical to do these assessments in the report. Instead, potential problem areas are identified on the basis of the weighted average concentration and total load of various elements listed in Appendix 7.2 and Table 19 of Chapter 5. For volatile solids, COD, oil and grease, TKN and ammonia, EPA dredged sediment guidelines were used from Appendix 3, since background concentrations for these parameters in the lakes were not available as for the other parameters in Table 19. The pollution loadings section of this chapter also gives an indication of where problem areas may be found.

The chromium load to Lake Huron from water disposal of dredged materials is about 60% of Canadian shoreline erosion loading, about 75% of direct municipal/industrial discharge loading but only 0.6% of total tributary loadings. Total potential dredged materials load is six times the Canadian shoreline erosion loading, about seven times the direct municipal/industrial discharge loading but only 6% of the size of tributary loading to Lake Huron.

The chromium load to Lake Erie from water disposal of dredged materials is about 9% of the estimated total lake loading. This load is about 23% as large as the load contributed by Canadian shoreline erosion. Total potential dredged materials loading is about 26% of the estimated total lake chromium loading and is about equal to the load from Canadian shoreline erosion.

The chromium load to Lake Ontario from water disposal of dredged materials is 3% of the total estimated lake chromium loading. This is about 33% as large as loading from Canadian shore erosion. The total potential dredged materials chromium loading is about 7% of the total estimated lake chromium which is about 71% as large as the loading from Canadian shoreline erosion.

DESIGNATION OF POTENTIAL PROBLEM AREAS

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BASIN			
Superior	32.67	13.42	[illegible]
Michigan	96.43	-	[illegible]
Huron	8.51	9.40	17.91
Erie	368.70	5.98	[illegible]
Ontario	35.60	4.24	[illegible]
TOTAL	541.90	33.05	[illegible]

The chromium load to Lake Superior from water disposal of dredged materials is 1% of total tributary sources. However, dredged materials disposal loading is 12 times greater than direct industrial/municipal inputs. Total potential dredged materials chromium load to Lake Superior compares in a similar manner to both municipal/industrial loading and tributary loading.

5. Guidelines for Project Evaluation

The Dredging Subcommittee has identified the following guidelines which should be considered in a site-specific review of a dredging project on the Great Lakes. For the most part the guidelines recognize existing review programs operative on the Great Lakes and consider procedures used elsewhere to assess dredging activities, e.g. ocean dumping legislation of the United States and Canada. The essential components of an evaluation are presented in Figure 4 and each of the ten steps are subsequently elaborated on. The information is not intended to be all-inclusive and essential references are provided to assist the reader in seeking clarification. The sequence of steps identified in the flow chart is not necessarily the most desirable, but may be dictated by existing knowledge, i.e. use of bioassessment is a preferred evaluative tool, but methodologies are still in the development stage.

HISTORICAL AND ECOLOGICAL EVALUATION

A brief historical review of dredging activities at a particular site is necessary for adequate and prompt project evaluation. Historical information for a particular dredging project should address the following: dredging frequency and extent, quantities of sediments, physical and chemical characteristics of sediments, known or suspected sources and types of potential sediment contaminants, past dumping sites of dredged sediments and the benefits and costs.

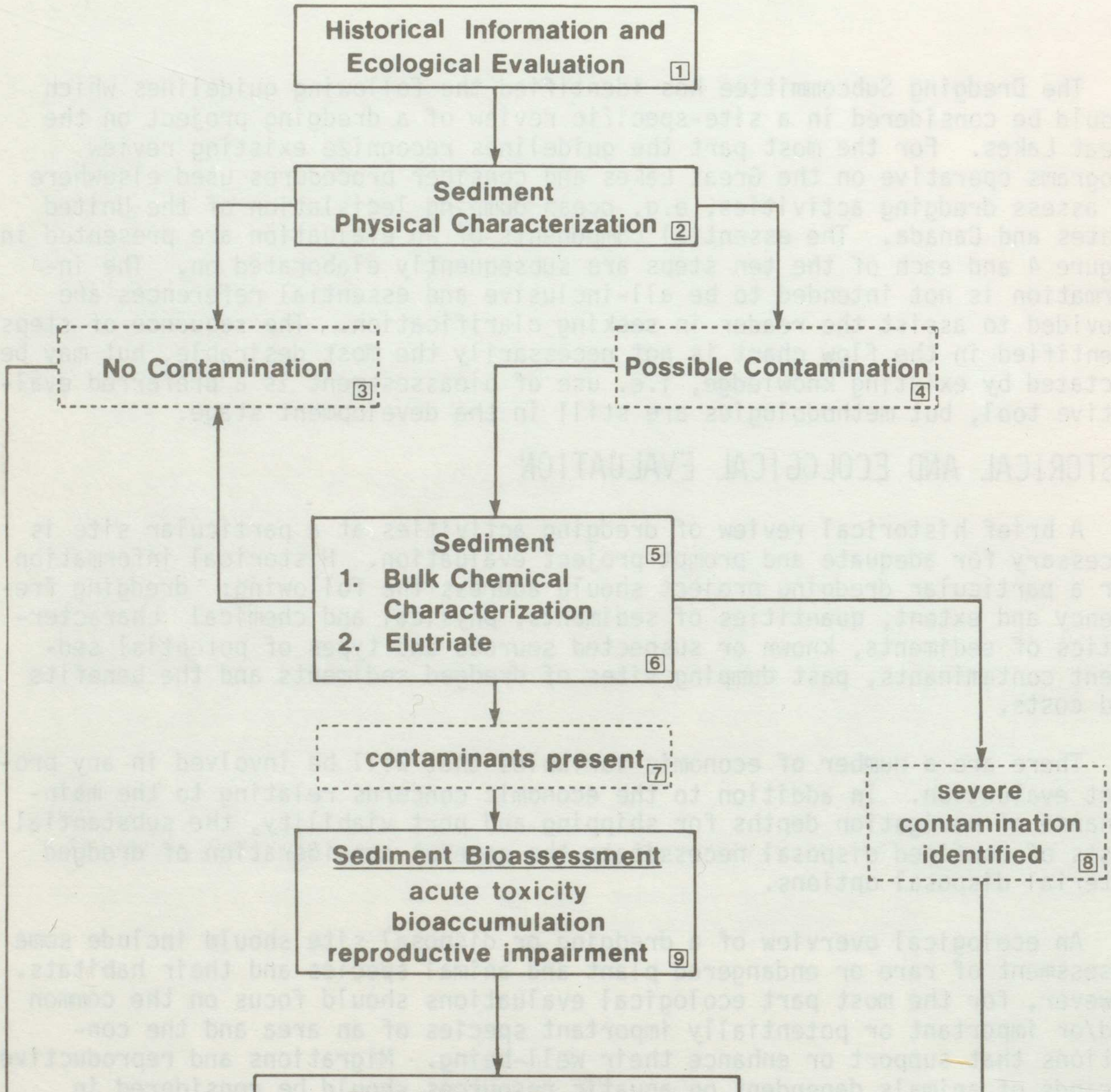
There are a number of economic variables that will be involved in any project evaluation. In addition to the economic concerns relating to the maintenance of navigation depths for shipping and port viability, the substantial costs of confined disposal necessitate the careful consideration of dredged material disposal options.

An ecological overview of a dredging or disposal site should include some assessment of rare or endangered plant and animal species and their habitats. However, for the most part ecological evaluations should focus on the common and/or important or potentially important species of an area and the conditions that support or enhance their well-being. Migrations and reproductive periods of animals dependent on aquatic resources should be considered in dredging evaluations. Any known elevated levels of heavy metals or synthetic organic compounds in the aquatic biota of the area should be documented. Existing information on abnormal rates and types of tumor formation in aquatic animals should be considered. Water quality in a project area should be known and changes estimated either during or following dredging.

PHYSICAL CHARACTERIZATION OF SEDIMENTS

The characterization of sediment particle size and composition is of great importance in determining potential uses and contamination levels. Sand and coarser inorganic sediments seldom retain contaminants. Finer sediments,

Fig. 4 FLOW CHART OF DREDGING PROJECT EVALUATION



especially organic sediments of planktonic origin, will usually contain the highest levels of contaminants in a given area. Plankton tend to remove heavy metals and fat soluble synthetic organic compounds from the water column and carry them to the bottom when they die. Non-biotic removal of contaminants from the water column results from chemical precipitation, binding to fine inorganic particles and complexing with dissolved organic substances.

ON-SITE EVALUATIONS

Sediment samples can generally be evaluated for possible contamination or uses at the time of collection based on the classification in Table 18, and such additional information as odours (normal, sewage, chemical, petroleum, etc.), the presence of oil and grease, and unusual deposits or colour that would further aid in evaluating possible uses or suggest contamination.

TABLE 18

SEDIMENT CHARACTERIZATION CATEGORIES

NAME	CHARACTERISTICS
Bed Rock	
Boulders	>256 mm or 10" dia.
Rubble	256 to 64 mm or 10" to 2.5"
Coarse Gravel	64-32 mm or 2.5" to 1.2"
Medium Gravel	32-8 mm or 1.2" to 0.3"
Fine Gravel	8-2 mm
Sand	Gritty texture, particles visible to naked eye
Coarse	2-0.5 mm
Medium	0.5-0.25 mm
Fine	0.25-0.0625 mm
Silts	0.0625-0.0078 mm
Clays	(<0.0078 mm) Smooth, slick texture, sticks to fingers
Marl	Gray, fragments of shells and Chara
Detritus	Wood, sticks, undecayed coarse plant material
Fibrous Peat	Partially decomposed plant remains
Pulpy Peat	Finely divided plant remains, green-brown
Muck	Black, very finely divided plant material

Modified from Roelofs (1944) and Wentworth (1922).

LABORATORY EVALUATION

Analyses of sediment particle size and organic carbon content of samples can be made in the laboratory to further ascertain the possible uses of dredged sediments. Analyses can be carried out by routine wet or dry sieving techniques, centrifuging, drying, weighing and ignition in a muffle furnace to determine organic matter content or by other suitable methods to determine total organic carbon. Sediments can be characterized as percentages of various particle size using the categories in Table 18. Sediment data can also be expressed on the basis of phi size if further statistical analysis is required (Krumbein and Pettijohn, 1938).

Detailed sediment analysis for particle size and organic matter content not only allow judgments to be made about possible uses, but indicate the possible impacts in areas of potential sediment disposal. Sediments with significant organic content could benefit open lake benthic communities which lack readily available energy sources. Coarser sediments placed in the open lake such as boulders and gravel, could be a valuable substrate not only for benthic animals but also for spawning sites for various fish species. However, disposal of sediments of a character different from that found at the disposal site can have substantial adverse impacts on the existing benthic community (see Appendix 2).

NO CONTAMINATION

Dredged material with an absence of appreciable contamination may be excluded from further evaluation if it meets one of the following guidelines:

a) material is composed predominantly of sand, gravel and rock and/or the material is found in areas of high current or wave energy such as streams with large bed loads or shoreline areas with shifting bars and channels;

b) material is for beach nourishment or restoration and is composed predominantly of sand or gravel with particle sizes and colour compatible with material on the receiving beaches;

c) material proposed for dumping is substantially the same in physical and chemical properties as the sedimentary materials at the proposed disposal site (where no chemical problems have been identified) and

d) proposed dredging and disposal operations are identical to a past activity which had been subjected to environmental review and no significant contamination has been known to have occurred in the meantime.

POSSIBLE CONTAMINATION

Insufficient information is available on the quality of the sediments and contamination may be suspected from the historical and ecological evaluation.

BULK CHEMICAL CHARACTERIZATION

The bulk analysis of sediments involves the determination of total concentrations of sediment constituents and does not recognize possible fractions of the sediment contaminant load that are available and detrimental to either water quality or the aquatic biota. To date, few cause-effect relationships have been established between bulk sediment concentrations and biotic impacts, and attempts to define the pollution status of a sediment solely on the basis of bulk analysis is questionable. One study on the Great Lakes (Michigan Technological University, 1977) did conclude that bulk analysis may be adequate to estimate biological effects in comparable single contaminant systems while another study using benthic bioassays (Prater and Anderson, 1977) found tentative relationships between observed benthic organism mortality and the bulk sediment classification system of EPA.

Within the limitations of analytical capabilities (there can be significant problems associated with the analysis of sediments due to complex chemical compositions), bulk analysis can be routinely used to provide an indication of relative sediment quality and to screen for parameters of concern in particular watersheds or basins of the Great Lakes. The information is also relevant to loading calculations and the development of the dredging register for the Great Lakes (Appendix 7).

During initial screening of sediments under evaluation, the information presented in Table 19 on the relative sediment quality in the Great Lakes can be used for comparison purposes. The concentration data are based on the basinwide means for parameters of concern. The fine-grained silts, clays and organic matter which predominate in the depositional basins of the lakes would contain higher concentrations of chemical constituents while concentrations in the coarse-grained nearshore material would be lower. In an interpretation of sediment quality at a dredge site, site-specific information on nearshore sediments, shoreline bluff material and soils within the watershed would assist in determining natural background conditions.

The categories in Table 19 follow those of PLUARG (1978) which ranked various trace elements according to their present or potential status as an environmental hazard. An element was included if it had the potential for transformation to a toxic methylated form or if the sediments and organisms were enriched with the element. Polychlorinated biphenyls (PCBs) were added to Category I and an additional category was established for phosphorus.

The list of parameters in Table 19 is not all-inclusive and the sediments should be characterized chemically as completely as possible. Additional chemical characterization of sediments may be needed depending upon the nature of the watershed and information gathered during the historical and ecological evaluations (see EPA and MOE guidelines in Appendix 3 for additional parameters). Concern should be focused on the persistent organics which are being identified in the Great Lakes Basin.

In an interpretation of sediment chemical data the following site-specific considerations are relevant:

a) chemical quality of sediments at a proposed offshore disposal site;

b) some investigators have identified contaminant enrichment of surficial lake sediments due to loadings from human activities:

TABLE 19

AVERAGE CONCENTRATIONS (DRY WT.)
OF SURFICIAL SEDIMENT CONSTITUENTS IN THE GREAT LAKES

	LAKE ONTARIO	LAKE ERIE	LAKE HURON	LAKE MICHIGAN	LAKE SUPERIOR
CATEGORY I µg/g					
PCBs	0.077-0.089[1]	0.074-0.252[1]	0.009-0.033[1]	0.0097[2]	0.030[1]
Mercury	0.65[3] (0.07)	0.58[4] (0.08)	0.22[4] (0.08)	0.107 (0.06)	0.08[4] (0.07)
Lead	106[3] (30)	112[4] (28)	49[4] (22)	40[6] (19)	44[4] (21)
CATEGORY II µg/g					
Arsenic	3.3[3]	3.2[6]	1.1[4]	10.5[5] (5.3)	1.7[4]
Cadmium	2.5[3] (1.3)	2.5[7] (1.1)	1.4[4] (0.7)	0.9[5]	1.2[4] (0.6)
Selenuim	1.0[6]	0.79[6]	0.9[6]	1.2[8] (1.8)[8]	0.6[6]
CATEGORY III µg/g					
Copper	50[3] (44)	39[7] (29)	32[4] (41)	22[5] (21)	82[4] (62)
Zinc	192[7] (105)	177[7] (98)	62[4] (83)	97[5] (74)	97[4] (106)
Chromium	48[3]	53[7]	32[4] (36)	46[5] (62)	163[4] (51)
Nickel	52[3]	49[4]	39[4] (47)	24[5] (36)	95[4] (57)
CATEGORY IV mg/g					
Total Phosphorus*	0.910[7]	0.960[7]	0.570[7]	0.650[9]	0.610[7]

*Total phosphorus as P.

( )Values in parentheses denote average natural or pre-colonial concentrations from depositional zones as determined by Kemp and Thomas (1976); Kemp et al. (1978); Frye and Shimp (1973). Lake Michigan values are calculated from Cahill (1981) and Frye and Shimp (1973).

[1]PLUARG (1978).

[2]R. Frank, R. L. Thomas, H. E. Braun, D. L. Gross and T. T. Davies. "Organo Chlorine Insecticides and PCB in Surficial Sediments of Lake Michigan (1975)" J. of G. L. Research, VII (1): 42-50. Int'l. Assoc. of G. L. Res. 1981.

[3]Implementation Committee Report to the Water Quality Board (1977).

[4]Implementation Committee Report to the Water Quality Board (1978).

[5]Cahill (1981).

[6]Traversy et al. (1975).

[7]International Working Group Report (1975).

[8]Cahill (personal communication).

[9]Frye and Shimp (1973).

Lake Ontario - Hg, Pb, Zn, Cd, Cu (Kemp and Thomas, 1976)
Lake Erie - Hg, Pb, Zn, Cd, Cu (Kemp and Thomas, 1976)
Lake Michigan- Hg, Pb, Zn, Cu, Cr (Leland et al., 1973)
Lake Huron - Pb, Zn, Ni, Cd (Kemp et al., 1978)
Lake Superior- Hg, Pb, Cu, Cd (Kemp et al., 1978)

c) significance of the dredging activity in aggravating offshore sediment quality relative to other identified point and diffuse sources of sediments and contaminants and

d) significance of controlling the dredging activity relative to other programs directed to control sediment and contaminant input to the lake.

THE ELUTRIATE TEST

BACKGROUND

The elutriate test is intended to simulate the dredging and disposal process. The test consists of mixing one part of sediment from the dredging site with four parts of water (volume basis) from the dredging site, shaking vigorously for 30 minutes then allowing settling for one hour. Centrifugation and filtration (0.45 μ filter) follow. The resulting filtered water is called the elutriate (Environmental Effects Laboratory, 1976).

APPLICATION

The elutriate is intended to represent the dissolved, immediately-releasable fraction of the various chemical constituents in the dredged material as the material passes through the water column following disposal. The elutriate concentrations, the dissolved concentrations at the proposed disposal site, applicable water quality standards and IJC water quality objectives are used together with physical characteristics of the disposal site and disposal method to calculate the mixing zone theoretically needed to dilute the dredged material discharge to an acceptable level. The calculated mixing zone is compared to the geographical limits of the authorized disposal site to determine whether the discharge will meet the applicable standards or objectives at the perimeter of the authorized disposal site (Environmental Effects Laboratory, 1976).

COMPARISON OF ELUTRIATE TEST RESULTS WITH ACTUAL RELEASES UPON DISPOSAL

Contaminants consistently released from sediments in the elutriate test include manganese and ammonia (Lee, 1976) as well as TKN and COD (Kizlauskas, 1979), and contaminants frequently released include TOC, arsenic and phenols, (Kizlauskas, 1979). For comparison, contaminants consistently released in actual disposal operations include manganese and ammonia (Wright, 1978), in general agreement with the elutriate test as noted above. However, in actual disposal operations, phosphorus is also found to be frequently released and TOC and arsenic infrequently released, in contrast to the elutriate test results (Wright, 1978; Sly, 1977).

The Ashtabula Aquatic Disposal Field Investigation (Wyeth and Sweeney, 1978) included a comparison of elutriate vs. actual release, i.e. monitored during actual disposal. The disposal operations were of the type most typical in the Great Lakes, discrete dumps of material from hoppers or barges. That study concluded that the elutriate test was not an adequate tool for characterizing dredged materials with regard to potential release of contaminants upon open lake disposal, since a number of variables, including PO_4-P and mercury that did not show marked release in the elutriate test were seen to increase significantly in the actual disposal operations monitoring.

Another comparison of elutriate results with field measurements involved a continuous pipeline discharge of dredged material (Grimwood and McGhee, 1979). Statistical analyses of the distributions of the elutriate releases and the actual measured releases showed good agreement for COD, chromium and phenol; slightly poorer agreement for cadmium, arsenic, TKN, nickel and zinc; and rather poor agreement for lead, mercury and copper.

Suggestions for improving the predictive capability of the elutriate test include: performing the test in the field as soon as the samples are collected (Letki and Wyeth, 1977); decreasing the percentage of sediment in the test from 20% to 5% (Lee et al., 1975) or less (Snitz et al., 1979) and aerating the sample during the test to keep the elutriate from going anoxic due to oxygen consuming contaminants in the sediments (Lee, 1976).

CONTAMINANTS PRESENT

Contaminants of concern, particularly those that are toxic or that bioaccumulate, are found at significant concentrations in the bulk sediment characterization and/or the elutriate test.

SEVERE CONTAMINATION IDENTIFIED

Severe contamination of the sediments may have occurred from past accidental spills or industrial discharges, e.g. PCB contamination at Waukegan, Illinois.

BIOASSESSMENT (EVALUATION OF SEDIMENT QUALITY)

The ultimate concern in evaluating any dredging or dredged material disposal activity is its impact on the biota. This discussion is limited to aquatic organisms, because they are most likely to be directly affected by dredging and dredged material disposal.

Because of the concern with pre-dredging testing of sediments, techniques such as sampling before, during and after dredging to measure species composition shifts, (ecological effects) will not be discussed in this section. For the purposes of this report, biological evaluation of sediment quality includes only pre-operational tests, exposure of appropriate organisms to sediments so that lethal or sublethal responses can be measured. Three basic types of tests can be employed: 1) Algal bioassays -- measuring effects of chemical constituents on primary production 2) Animal bioassay -- measuring acute toxicity or chronic effects such as reproductive impairment and 3) Accumulation studies -- measuring any increase of persistent and/or toxic contaminants due to exposure of the animals to sediments.

Before biological evaluations of sediment quality can be employed, standard procedures and reasonable criteria for evaluating the results of these tests must be developed. The following sections discuss some approaches on how standard procedures and appropriate criteria could be developed and used.

GENERAL PROCEDURES

Consistent with other hazard evaluation techniques, the procedures for testing sediment should simulate the "worst case." Any pre-operational testing will by definition require the collection of representative sediment from an area to be dredged and the subsequent laboratory exposure of appropriate organisms.

Methods for conducting phytoplankton and animal bioassays as well as bioaccumulation procedures are published in Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters, (EPA and Corps of Engineers, 1977). These methods are quite detailed concerning the statistical considerations for this type of work, but some are lacking in details of how to conduct the exposures. The procedures given for bioaccumulation studies are especially vague. Conducting liquid phase bioassays using phytoplankton as described by the referenced document should provide a reasonable evaluation of the relative nutrient enrichment of the dredged material and the short-term effects this enrichment may have on primary production. Both the animal bioassay and the bioaccumulation procedures were designed to simulate the disposal of dredged material, making an attempt to separate the effects of the sediment liquid phase from the solid phase. However, organisms including fish are exposed to sediments during dredging, often in confined harbours, and because the sediments disturbed during the dredging activity are usually anaerobic, the potential effects are greatest at that time. Therefore, to conduct studies (bioassay and bioaccumulation) designed to evaluate the "worst case", the exposure should include sediment comparable in chemical condition to that found at the time of collection. The organisms should be exposed to a slurry of these sediments, simulating conditions of dredging or continuous disposal. Liquid phase testing evaluates the potential effects of contaminants released from the sediment (usually aerobic sediments due to collection and storage techniques), but organisms may accumulate contaminants directly from the solids in the sediments without any measurable release to the liquid phase. The combination of stress due to both the increase in suspended solids and chemical contaminants associated with the sediments may cause substantially greater effects on the organisms than exposure to either the liquid or solid phase individually.

TEST ORGANISMS

Selection of test organisms is an extremely controversial topic. For animal exposures, the organisms used most frequently are bottom dwelling sessile animals such as mollusks or immature insects. Because these invertebrates generally have low lipid content and usually eliminate contaminants rapidly, they make poor concentrators of organic (low solubility in water) compounds. Many of the Great Lakes harbours function as rearing grounds for juvenile fish, so that when these harbours are dredged the contact between the sediments and these young fish temporarily increases. Therefore, young fish, possibly yellow perch or channel catfish (both commonly found in the Great

Lakes), would make excellent test organisms for bioaccumulation studies. For bioassays where acute toxicity or reproductive success is to be measured, zooplankton would make excellent test organisms, considering their relative sensitivity to contaminants and relatively short life cycles. The origin of the test organism should be from laboratory or hatchery stock allowing much better comparability between tests on different harbours and assuring that organisms will be available in adequate numbers at all times of the year.

CRITERIA FOR TEST RESULTS

Evaluating the results of a bioassay or bioaccumulation test can be a difficult process. Setting criteria for judging results from acute toxicity tests has always been a difficult, rather subjective, exercise. Current water quality criteria are derived using an estimate of the concentration of a given contaminant that kills 50% of the organisms and this LC_{50} value is multiplied by a safety factor or application factor based on results of chronic tests. A no-effect concentration, usually a very dilute concentration, is calculated and used as a criterion. Unfortunately, dilution is not a realistically achievable solution to alleviate the toxicity of sediment contaminants associated with dredging or continuous disposal. Therefore, we must develop testing protocol that compares the toxicity of the sediment to be dredged with a reference sediment, rather than calculating a no-effect concentration. Or it must decide how much mortality is acceptable. Use of sediment from the disposal site as reference material results in a serious risk because the material at the disposal site may be from a previous disposal operation.

In the absence of a suitable reference sediment, the number of organisms that can be killed without altering the balance of the ecosystem in question has to be determined, currently a difficult if not impossible task. Setting criteria based on reproductive impairment studies is even more tenuous because these data represent only the numbers of organisms that might not be produced as a result of exposure to sediments. Criteria for evaluating the results of bioaccumulation studies could be simple as stated in Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, (EPA and Corps of Engineers, 1977) as follows: "Therefore, this guidance recommends the environmentally protective approach of assuming that any statistically significant difference in tissue concentrations between control and exposed organisms are a potential cause for concern." Stating that any significant accumulation of contaminants is potentially harmful need only be qualified by stating that the relative toxicity of various contaminants should be considered when evaluating the seriousness of the observed accumulation. For example, chlorinated hydrocarbons are more toxic to aquatic organisms than iron. Relative toxicities for many compounds and elements are published making this approach quite possible. In addition to considering direct effects of increased burdens of contaminants on aquatic organisms, bioaccumulation that may eventually affect higher levels in the food chain, including human beings, must be considered.

SUMMARY

Bioassessment of sediments should be conducted on a "worst case" basis simulating the potentially most rigorous conditions during dredging or disposal. Standardized procedures must be developed for conducting bioassays and bioaccumulation studies; meaningful criteria must be adopted to evaluate bioassay results and criteria for bioaccumulation tests should state that any accumulation of toxic materials by test organisms should be considered a cause for concern.

EVALUATION OF DREDGED MATERIAL DISPOSAL OPTIONS

During a site-specific evaluation of dredged material disposal options, all practical alternatives to the discharge of materials into the waters of the Great Lakes should be considered.

The use of dredged materials for any one particular need or project is dependent upon the type of material to be disposed of and the degree of contamination. This should be further refined as to the type of contamination, e.g. heavy metals or organic pollutants. When excessive contamination is evident, the material should be confined to preclude any percolation into adjacent water bodies or into the groundwater. In the consideration of disposal options all local, state/provincial and federal laws, regulations and guidelines governing such disposal must be addressed and conformed to.

A considerable amount of experience has accumulated on dredged material disposal options and much of this experience is documented in the reports of the Dredged Material Research Program of the U.S. Army Corps of Engineers. Options and/or uses of dredged material are outlined below.

AGRICULTURE

Dredged material can be used beneficially to enrich soils for agricultural purposes, particularly when marginal soils of low productivity are located in the vicinity of the dredging area (Gupta et al., 1978). For guidance when considering the implications of contaminants in the material, one should refer to the guidelines or regulations which are being developed in the jurisdictions for the land application of sewage sludge. In some cases, areas used for non-food crops (e.g. tree and sod farms) may be preferred.

RECREATIONAL

Dredged material containment areas, e.g. parks, marinas, have provided recreational use benefits in a number of cases (Walsh and Malkasian, 1978). A significant amount of recreational development is occurring along the shorelines of the Great Lakes and opportunities are often available to incorporate dredged materials into associated structures.

INDUSTRIAL

Filled areas along waterways provide desirable sites for many municipal and industrial uses such as factories and water treatment plants (Walsh and Malkasian, 1978). They are particularly desirable where the factory or industry is to be serviced by shipping. However, impacts of such filling on the environment must be carefully evaluated.

HABITAT DEVELOPMENT

Observations have indicated many species of fish are attracted to areas where there is protection, cover and food sources. It may be possible to provide such conditions through careful placement of dredged material so as to produce a suitable bottom topography. Uncontaminated material can be placed on the lake bottom in the form of submerged reefs or random hummocks. Whether or not the need exists to armour these areas with rock or similar material is dependent upon the nature of the material to be placed, the depth at which it is placed and the water currents in the area.

Much the same effect can be achieved with confined contaminated material in the form of barrier reefs. Prolonged high water levels and storm induced wave action along many beaches of the Great Lakes have created severe shoreline erosion and wetlands degradation. Well planned placement of confined disposal facilities and barrier reefs will not only stop this degradation but would result in the restoration of the marsh habitat. These reefs must be armoured with large stone riprap to protect the integrity of the confinement area. An example of such a use can be found at Point Mouillee in the western basin of Lake Erie where a 700 acre containment area is being developed to protect a large waterfowl marsh managed by the State of Michigan.

Frequently, dredging projects in the Great Lakes are located in the flyways of migratory waterfowl and other aquatic birds. Disposal areas, properly planned and vegetated, can produce excellent avian habitat and resting sites (Soots and Landin, 1978). Some of these sites can be extended to other wildlife and upland habitat uses (Hunt et al., 1978).

Another use which has not been fully explored in the Great Lakes concerns the development of wetland habitat (U.S. Army Engineer Waterways Experiment Station, 1978). The concern for the loss of wetland habitat in the Great Lakes would make this an attractive alternative, particularly in an area like Lake St. Clair.

WATERWAY DEVELOPMENT

Disposal areas will also aid in the expansion of many harbour facilities, such as docks, slips and possibly marinas. Uses can also be extended to breakwaters and flood control structures. As in the discussion of barrier reefs above, care must be exercised to ensure that the integrity of these types of structures is maintained, not only because of the contaminants confined within, but for the safety of the people and property being protected.

Dredged material has been used for navigational purposes in the St. Lawrence River to create islands for the retention of ice outside the navigation channel.

BEACH NOURISHMENT

Clean, dredged sand is ideal for nourishing beaches which have been eroded by wave action. Although most hopper dredges are limited to depths of 18 feet or greater, the use of sand by-pass equipment can move the sand to the shallow areas along the shoreline. Care must be taken to ensure that valuable fish habitat is not impacted in such a program.

RE-USE

Uncontaminated sand can also be stockpiled for future uses in construction, industry or winter road sanding to increase traction.

Dredged material can also be used as landfill cover, confined where appropriate, and as fill material for various types of development. In addition, the use of dredged material for the reclamation of strip-mined areas is possible.

OPEN WATER DISPOSAL

If the dredged material is identified as uncontaminated and no feasible alternative disposal solutions are available, open water disposal may be considered. Guidelines to consider in the selection of a site include:

a) the chemical and physical characteristics of the substrate at the disposal site should not be degraded;

b) the site should be removed from the vicinity of municipal and private water supply intake zones, recognizing the potential for transportation of the dredged material in the liquid or suspended particulate phases into the vicinity of a water supply intake zone;

c) the site should be removed from a recognized commercial or recreational fishing ground and from spawning, nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes;

d) the site should be in a non-erosive section of the lake to prevent spread of the material to areas outside the disposal area and

e) the site should be removed from areas of recreational and aesthetic values.

[illegible] or not the need exists to armour these areas with rock or similar [illegible] dependent upon the nature of the material to be placed, the depth at which it is placed and the water currents in the area.

[illegible] wave action [illegible] line erosion and wetlands degradation. Well planned placement of confined disposal [illegible] would result in the restoration [illegible] armoured with large stone riprap to protect the integrity of the containment [illegible]

Frequently, dredging projects in the Great Lakes are located in the [illegible] ways [illegible] life and upland habitat was [illegible]

[illegible] the navigation [illegible] Station, 1984). The concern for the loss of wetland habitat in the Great [illegible] Lake St. Clair.

HARBOUR DEVELOPMENT

Disposal areas will also aid in the expansion of many harbour facilities, such as docks, slips and possibly marinas. Uses can also be extended to breakwaters and flood control structures. As in the discussion of barrier reefs above, care must be exercised to ensure that the integrity of these types of structures is maintained, not only because of the contaminants confined within, but for the safety of the people and property being protected.

Dredged material has been used for navigational purposes in the St. Lawrence River to create islands for the retention of ice outside the navigation channel.

BEACH NOURISHMENT

Clean, dredged sand is ideal for nourishing beaches which have been eroded by wave action. Although most hopper dredges are limited to depths of 10 feet or greater, the use of sand by-pass equipment can move the sand to the shallow areas along the shoreline. Care must be taken to ensure that valuable fish habitat is not impacted in such a program.

RE-USE

Uncontaminated sand can also be stockpiled for future uses in construction, industry or winter road sanding to increase traction.

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Appendix 1
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Appendix 2

FINAL SUMMARY - THE DREDGED MATERIAL RESEARCH PROGRAM*

Although all research activity under the Dredged Material Research Program (DMRP) ended on schedule in March of last year, it has taken since then to complete publication of the more than 250 detailed technical reports and 21 synthesis documents. The complete wrap-up of the DMRP is in sight but not yet actually achieved in that the single-volume summary report and the accompanying index and retrieval system are still in publication with distribution scheduled within the next several months.

As the first part of the final report, there is a concise narrative summary aimed at the manager/executive whose activities and responsibilities call for an overview of the significance and utility of the research results rather than detailed findings. Because of the extent of this audience, the summary from the final report is presented in this issue of the Information Exchange Bulletin, amended with marginal key words to further assist the reader in pinpointing areas of special interest.

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*From U.S. Army Corps of Engineers. Dredged Material Research Notes, News, Reviews, etc., Vol. D-79-2 (June 1979), 1-10

General

Background At the beginning of this decade, the concern over the environmental impacts of dredging to maintain navigable waterways and harbors and the disposal of the dredged material reached the stage where Federal legislation was necessary. However, it was recognized that the technical base on which the initial legislation was based was inadequate--existing information was limited to site-specific studies that permitted only inferences that the open-water disposal of polluted dredged sediments presumably must be harmful to the environment. It was in this context that the need for a comprehensive nationwide research program was recognized and authorized by Congress (Public Law 91-611).

The DMRP Responding to this need for more basic information on all types of dredged material disposal and possible alternatives to existing methods, the Corps of Engineers undertook the Dredged Material Research Program (DMRP) via the Waterways Experiment Station in Vicksburg, Mississippi. Initiated in 1973, the DMRP was accomplished in the planned 5-year time frame at a cost of $32.8 million. Highly interdisciplinary in nature, it was a tightly managed, basically contracted (70% of total research funds), extensively coordinated effort involving more than 250 individual studies.

Scope and approach These consisted of a planned and phased mixture of conceptual, laboratory, and field studies in association with actual scheduled Corps projects designed to understand the processes and mechanisms involved in environmental impacts. To an extent not possible previously, this generic approach was intended to permit the development of much-needed methods for predicting effects before a project is carried out or a permit issued under regulatory functions.

Applicability The DMRP was designed to be as broadly applicable as possible on a national basis with no major type of dredging activity or region or environmental setting excluded. It thus resulted in methods of evaluating the physical, chemical, and biological impacts of a variety of disposal alternatives--in water, on land, or in wetland areas--and produced tested, viable, cost-effective methods and guidelines for reducing the impacts of conventional disposal alternatives. At the same time, it demonstrated the viability and limits of feasibility of new disposal alternatives, including the productive use of dredged material as a natural resource.

Technology transfer Before summarizing the more significant finds of the DMRP, it is important to note that extensive efforts were taken to ensure effective information dissemination and technology transfer. In addition to a wide variety of publications designed to meet the varying requirements of different audiences, the technical staff that managed the

DMRP repeatedly briefed Corps and non-Corps personnel at all levels throughout the nation and participated in several interagency coordinating and planning committees. Of greater significance were the efforts to incorporate research results into Corps regulations and operating procedures and into the criteria and guidelines developed for regulatory programs. In the latter case, both the Section 103 (Public Law 92-532) and 404 (Public Law 92-500) programs for ocean and inland water protection have profited from results of the DMRP and will continue to do so as efforts progress to prepare technical implementation manuals for both programs.

Regulatory criteria applications

General conclusions

To those concerned with national or regional planning and policy formulation, there are two extremely important fundamental conclusions that can be drawn from the DMRP. The first is that there is no single disposal alternative that presumptively is suitable for a region or a group of projects. Correspondingly, there is no single disposal alternative that presumptively results in impacts of such nature that it can be categorically dismissed from consideration. Put in different terms, there is no inherent effect or characteristic of an alternative that rules it out of consideration from a technical standpoint prior to specific on-site evaluation. This holds true for open-water disposal, confined upland disposal, habitat development, or any other alternative.

Viability of alternatives

Case-by-case evaluations

Specific on-site evaluations mean that each project must be considered on a case-by-case basis. It is not technically sound, for example, to make the general statements that ocean disposal must be phased out or that all material in the Great Lakes classified as polluted must be confined behind dikes. To do this would be contrary to research results that have indicated that there can be situations where there is greater probability of adverse environmental impacts from confined disposal than from open-water disposal. Yet, in other situations such as when certain types of contaminants are present, confined disposal may provide the greatest amount of environmental protection.

Management implications

Implications of this conclusion from a management point of view are fully recognized. Case-by-case evaluations are time consuming and expensive and may seriously complicate advanced planning and funding requests. Nevertheless, from a technical point of view, situations can be envisioned where tens of millions of dollars may have been or could be spent for alternatives that contribute to adverse environmental effects rather than reduce them.

Long-range regional planning

The second basic conclusion is that environmental considerations are acting more strongly than possibly any force to necessitate long-range regional planning as a lasting, effective solution to disposal problems. No longer can disposal alternatives be planned independently for each dredging operation for multiple projects in a given area. While each project may require a different specific solution, the interrelationships must be evaluated from a holistic perspective and thought given to when particular disposal alternatives may have to be replaced with others as conditions change. Regional disposal management plans not only offer greater opportunities for environmental protection ultimately at reduced project cost, but also meet with greater public acceptance once they are agreed upon.

Disposal management plans

Aquatic Disposal

Physical effects in water

Considering first the specific findings with regard to the effects of open-water disposal, the physical effects--the logical and easily predicted physical effects--are with few exceptions more important than chemical or biological effects. Physical effects include the smothering of a clam bed, the disruption of a flow pattern, a change in salinity, or a similar effect. These possible consequences of disposal operations are persistent, often irreversible, and compounding. However, they are infrequent and can be avoided with the judicious application of evaluative procedures available under guidance for the Section 404 and 103 programs. More intense evaluations of physical impacts traditionally have relied on physical hydraulic models, but the DMRP developed mathematical models that can also be used for certain needed predictions. Specifically, a partially verified and tested math model is now available to predict the short-term fate or dispersion of barge and hopper dredge dumped material as well as pipeline dredged material in ocean, estuarine, lake, and river environments. An unverified sediment transport model for the long-term and ultimate fate of these deposits is now available.

Dispersion models

Viability of ocean disposal

Contrary to much public, scientific, and governmental opinion, the deep ocean, when analyzed in a detailed objective fashion, is not everywhere a fragile environment totally unacceptable for dredged material disposal. A significant contract study concluded that, should the economic and technological aspects be favorable, extensive deep ocean areas are more environmentaly acceptable for disposal than are some highly productive continental shelf areas, especially for contaminated materials.

Water quality effects

Turning to inland and coastal areas, the DMRP achieved definitive results that soundly substantiate that most widely held fears over the short-term release of contaminants to disposal site waters are unfounded. As long as the geochemical environment is not basically changed, most contaminants are not released from the sediment particles to the water. However, in contrast, upland disposal often does result in a change in the geochemical environment that can lead to contaminant release. Some nutrients such as ammonium and manganese and iron are released in open-water disposal, but in most cases enough mixing is present to rapidly dilute these to harmless concentrations. Situations where toxic effects could occur would most likely be where pipeline dredges are discharging large volumes of material into very shallow estuarine waters.

Nutrient releases

Effects of turbidity

The difficult problem of the effects of turbidity or suspended sediment particles on both water quality and aquatic organisms was addressed with significant results. It was found that, except in unusually environmentally sensitive areas such as coral reefs, turbidity is primarily a matter of aesthetic impact rather than biological impact. It is, of course, often advisable to schedule dredging and disposal operations to avoid disrupting spawning activities and fish migrations. However, studies showed that most adult organisms can tolerate turbidity levels and durations far in excess of what dredging and disposal operations produce. These studies, conducted in the laboratory and verified in the field, involved a variety of marine, estuarine, and freshwater organisms.

Organism tolerance

Benthic organism effects

With regard to benthic or bottom-dwelling organisms, their resiliency, once beyond the larval stage, was demonstrated. Disposal sites can be and are rapidly recolonized by the establishment of new populations, by migration or organisms from adjacent unaffected areas, and by survival of the organisms buried. Colonization by opportunistic species can occur within weeks and by the original species within months. When the type of dredged material disposed at a site is of the same grain-size distribution as the natural bottom (e.g., sand deposited on sand or silt on silt), survival of existing organisms is maximized. Conversely, a mismatch of sediment type can be quite detrimental. The condition that could be most injurious to benthic organisms is when the disposal operations, primarily hydraulic pipeline operations, produce a fluid mud or "fluff" layer that is a difficult and alien environment for many organisms.

Fluid mud phenomenon

Contaminant uptake

It was shown that certain aquatic organisms will uptake chemical contaminants from dredged material. However, the patterns of uptake were found to be unpredictably erratic and there were no clear trends.

Different types of organisms will uptake different quantities of contaminants such as heavy metals depending on an apparent variety of environmental and biological factors. The complexity of this process and the low level of predictive capability have been controlling factors in

Bioassay requirements

the decisions that bioassays must be an integral part of the evaluative criteria used in implementing the Section 404 and 103 programs. It is fully realized that bioassay tests are expensive and time consuming, but the state-of-the-art allows no effective alternative for determining how organisms will be affected by contaminated dredged material.

DMRP field studies

Beneficial effects

Determining the effects of open-water disposal has been somewhat like trying to strengthen a chain. Once the weakest link is found and strengthened, attention is necessarily then directed to the next weakest link. Major DMRP field studies of open-water disposal sites strengthened several links. They verified several major laboratory findings and showed that short-term impacts are quite brief and are not of major environmental significance. These indeed can occur, but are certainly going to be the exception rather than the rule. In addition, studies have called attention to situations where open-water disposal has even had beneficial environmental effects and have identified operational procedures that can be used to reduce impacts without new technology or major cost increases.

Long-term biological impacts

The next weakest link in the strengthened chain involves long-term biological impacts. Certain selected field test sites will be monitored for 3 years beyond the end of the DMRP to provide some much-needed information on this subject; however, many answers still will not be forthcoming. Among these will be ones relating to chronic or sublethal effects of very long-term exposure of benthic organisms to contaminated material and effects on reproduction.

Mitigation of effects

Turbidity reduction

Thus far, mention has been made primarily of assessing the effects of open-water disposal and very little about controlling or mitigating effects when they occur. This aspect was not overlooked, and even when an effect was found to be an unlikely event, it was presumed there could be instances where control or regulation would be advisable for one reason or another. A good example is turbidity. Even though adverse biological effects are highly unlikely, there may be reasons why excess turbidity should be minimized. One study called attention to how simple equipment maintenance and efficient operation can reduce turbidity and another extensively evaluated and developed guidelines for using silt curtains or "diapers," pointing out when they can be effective and when they will only mask the problem and not alleviate it. For example, silt curtains are ineffective where currents exceed 1 knot and will be both ineffective and uncontrollable under moderate wave conditions.

Submerged discharge concept

The DMRP included considerations of dredging equipment development in very few cases as this was largely beyond its scope. However, because of the peculiar nature of the problem of turbidity, a concept was developed for the submerged discharge of material from a hydraulic pipeline dredge through a specially designed underwater diffuser. Model tests of the diffuser showed it has excellent potential for reducing turbidity as well as for reducing the extent of the potentially harmful fluid mud layer that so often develops.

Material treatment

Oxygenation

Flocculents

On a related subject, various studies considered the feasibility of treating contaminated dredged material to reduce the impact of disposal operations. Because of the large volumes and variable nature of the material involved and the very low concentrations of contaminants, most conventional treatment processes are infeasible (sic), particularly when considered for use in the dredging operation itself. Some processes are feasible for confined disposal facilities and are discussed later. However, with regard to open-water disposal, only in-line oxygenation to reduce the dissolved oxygen sag accompanying disposal of certain kinds of material being moved by a pipeline dredge appears operationally and economically practical. The use of flocculents to reduce turbidity in an open-water disposal situation is not effective or practical in most situations.

Hopper dredge overflow

Overflow turbidity reduction

No studies directly addressed the issue of hopper dredge overflow as this is not a disposal problem per se. Nevertheless, program results do shed some light on this matter since turbidity from overflow is no different from that resulting from other dredging-related causes. In many, if not most, cases, this practice should result in no significant impact; however, there is an element of risk involved since the fine-grained materials overflowed are the ones that contain the relatively highest contaminant loads. The negative public image of this practice is widespread and there can be situations where aesthetic impacts are more important than biological impacts. A study of foreign dredging practices and technology showed that there is a simple and inexpensive technique developed in Japan that shows promise for significantly reducing the amount of surface turbidity associated with hopper dredge overflow.

Upland Disposal

Confined disposal

Confined or diked containment of dredged material as a conventional alternative was also extensively investigated. Confining contaminated material on land or in shallow water next to land can be an environmentally sound and preferred alternative, but not inherently better than open-water disposal for several reasons. There are technical reasons why confined disposal could be less effective in protecting water quality or organisms. These include the change in the geochemical environment that could lead to an enhanced release of contaminants and the difficulty in retaining the finer grained particles in environmental settings where they are likely to have greater impact when released (e.g., wetlands or small streams). Also, it should not be overlooked that confined facilities are expensive, of finite life, and result in a permanent change in the physical landscape, often in conflict with land-use and management plans.

Containment area problems

Irrespective of the alternative decision, if a confined disposal area is to be constructed, it must be designed, built, and operated in such a way as to achieve maximum effective capacity and satisfactory effluent quality. Unfortunately, historically, neither of these basic objectives has been met by most of the facilities that have been built. These objectives are by no means mutually incompatible and the reasons they have not been met involve lack of technical knowledge as well as policy and institutional factors such as cost, funding sources, and diffused construction and management responsibilities.

Containment area objectives

The DMRP developed and issued in report and manual form a variety of guidance and information that should largely alleviate the technical knowledge limitation. No longer is it necessary to rely primarily on "rules of thumb" and personal experience. Specific guidelines were prepared for designing containment areas with appropriate storage capacities, surface areas, and shapes; designing and building dikes; designing and placing inflow pipes and weirs; selecting equipment for operating in disposal areas; landscaping containment areas; and controlling problems such as mosquito breeding and noxious odors.

Construction and operation guidance

If a confined disposal site is to be effective from an environmental protection standpoint, it must be efficient in retaining a high percentage of the finer soil particles, for it is the clays and silts that carry the contaminants. These are admittedly the materials most difficult to retain in an area, but if they can be, the effluents should be essentially nontoxic except for occasional situations where nutrient levels and oxygen depletion may be excessive.

Material retention

The guidance mentioned above contains specific information on how disposal site retention times can be maximized; however, there are cases where sites are simply incapable of providing adequate retention. Addressing these situations, studies found that coagulants and flocculents can be quite effective for effluent treatment, and treatment system design and operation guidelines were

Effluent treatment

developed based on actual field tests. Studies also considered the principles involved in the land treatment of wastewater and concluded from a limited field test that the regulated discharge of disposal area effluents through a natural marsh can be effective in removing nutrients.

Potential leachate effects

With time, the soil physicochemical environment in a confined disposal site can become appreciably different from that of sediments before dredging or sediments deposited in open water. The upland drained situation can lead to an oxidizing acidic environment that was shown in laboratory studies to be conducive to the leaching of contaminants, particularly heavy metals. Whether or not the leachate will contaminate groundwater will depend on the absorptive capacity of the natural soil, which is normally quite high. A far more serious and more probable impact can occur when saline sediments are placed in a freshwater upland environment. Salt will leach from most dredged material and whether or not it will contaminate groundwater must be carefully evaluated on a case-by-case basis.

Reducing land requirements

In terms of time, effort, and cost, the most expensive aspect of confined dredged material disposal can be the land acquisition. The DMRP included studies aimed at alleviating or lessening this problem. These dealt with methods to increase the storage capacity of existing sites and/or concepts for making existing sites reusable.

Disposal site dewatering

Field tests proved that it is possible to dewater even some of the more difficult types of dredged material so that disposal sites can store more sediment and less water. A side benefit of this dewatering is improved engineering characteristics of the densified material. Through field investigations and tests, surface trenching with an available surplus Marine Corps vehicle called the Riverine Utility Craft proved to be cheap and effective in providing natural drainage. Whereas more complex and even exotic dewatering methods such as underdrainage systems and electro-osmotic dewatering may be feasible where the cost can be justified, here is a case where the cheaper technique, relying heavily on nature, was shown to be generally the most effective.

Trenching

Dredged material reuse

Dredged material, particularly dewatered dredged material, has value for landfilling or in construction. Every cubic yard that can be removed from a containment area and used, donated, or sold offsite for any purpose is a cubic yard of new storage capacity gained. In conjunction with the Corps Districts, concepts were developed for disposal area reuse for both existing and planned disposal sites. Numerous possibilities exist for separating and handling materials in a site, and actual field situations have demonstrated that uses within the site for purposes such as haul road construction and dike raising are too often overlooked as completely viable concepts.

Habitat Development

Creating wildlife habitats

Dredged material is also a substance that can be used to create or improve wildlife habitats--examples of this already exist in nearly all parts of the country. However, it is known that the past occurrences were primarily accidental rather than planned. Realizing that even the most productive habitats sometimes can be out of place within an ecosystem, the DMRP concentrated on understanding the natural processes and developing guidelines on exactly what should be done, where and when, and what are the relevant considerations in all phases from site selection to follow-up management.

Wetland plant productivity

Plant recovery from burial

Certain basic studies were concerned with wetland plant productivity from two points of view. Knowing the relative productivity of a species is one factor in selecting those suitable for planting at a habitat development project. It is also one factor in the extremely difficult problem of determining the value of a wetland being evaluated as a disposal site. Studies showed, for example, that the productivity of several so-called minor species is greater than anticipated and the ability of at least one species to recover from burial beneath dredged material up to 9 inches thick is greater than expected. This information will be helpful in selecting areas and methods of disposal should a wetland area have to be used for disposal.

Contaminant uptake

Predictive tests for uptake

Considerable attention was given to the uptake of chemical contaminants by marsh plants as an obvious concern in decisions on developing marsh habitat using dredged material. Uptake was found to occur in different ways and at different rates in most plant species, but the amounts of contaminants involved were not so large as to cause major concern. The question of how much uptake is too much was not resolved and is not likely to be anytime soon; however, evaluations of uptake should be made with an awareness of the natural functioning of a wetland system as a contaminant processor. The end product sought by the research was a test that can be used to predict the pattern of uptake from a particular type of material. To this end, it was largely, but not entirely, successful since certain contaminants have proven difficult to predict as far as behavior is concerned.

Marsh creation alternative Marsh creation using dredged material is now a proven, viable alternative that can be designed and implemented as reliably as any other alternative. Also, certain misconceptions about this alternative were firmly dispelled. In particular, it can be easily demonstrated that marsh development does not necessarily eventually preclude the disposal of material from subsequent maintenance dredging projects. There are examples where phased marsh development, with or without other disposal alternatives, has been planned in such a way as to accommodate maintenance dredging for periods of 50 years or more.

Operational difficulties While marsh development is a field-tested and proven alternative, it is not a simple one and it is not cheap. However, costwise, it is definitely competitive with other alternatives and cheaper than some. Marsh development is not unusually difficult from an engineering point of view, but it is difficult operationally in relative rather than absolute terms. By this, it is meant that no new equipment or technology is needed, but rather dredgers are required to perform unfamiliar operations according to unusual time and accuracy specifications. The operations can be done, but they will require close coordination and cooperation.

Site selection As indicated earlier, marsh development is not a satisfactory alternative for all locations, but there is no major geographic region where it is not desirable and possible somewhere. Marshes can be developed in the Great Lakes area and along inland river systems as well as in all coastal areas. The only known environmental conditions in which it is probably not practical are ones with high tidal ranges and strong waves and/or currents. Otherwise,

Development possibilities depending on local conditions, marshes can be developed in a variety of shapes and sizes, with different placement methods, with different types of dredged material, with different plant species and planting techniques, and with or without retaining dikes. Specific guidance was prepared for each of these considerations and is supplemented by decision methodologies useful in selecting sites and particular habitat development goals.

Upland habitat development In some respects, the development of upland habitat, either on new disposal sites or by reclaiming old sites, is a technology more advanced and more tested than marsh habitat development. Upland habitat includes such situations as food and cover for mammals and nesting, resting, or feeding areas for waterfowl. Most of these require only the application of existing agronomic and wildlife management practices. But availability is useless without awareness, so this information was compiled and synthesized for widespread distribution. Upland habitat development can be relatively inexpensive and is not difficult, and there are hundreds of disposal sites that could be improved environmentally and meet with greater public acceptance if improved in this way.

Island habitats

Small islands created by dredged material disposal in inland waterways and coastal bays and estuaries are a special type of upland habitat development. Several regional surveys showed that many of the more than 2000 of these islands have become extremely valuable wildlife habitat. In fact, maintenance of the U.S. population of several colonial nesting birds such as sea gulls, terns, and herons is dependent upon islands of this type.

Island design and management

Thus, island development obviously can be an environmentally beneficial disposal alternative and one that has large public acceptance. The DMRP provided guidance on how islands can be designed and managed to be of greatest value to certain target species and how the natural evolution of the islands can be controlled for maximum wildlife benefit. However, there are problems, both real and imagined. In the former category are the conflicting concerns and needs of the wildlife interests and the fisheries interests who often have opposing views on the need for islands versus open water. This type of problem can only be resolved on a case-by-case basis. In the latter category is the widespread belief that once an island is created and inhabited by desirable wildlife, it can never again be used as a disposal site. This is not true! In fact, studies showed that unless natural vegetational successional patterns are occasionally interrupted, the islands will lose their wildlife value. The most practical way of providing the needed interruption is by depositing a new layer of material. Specific guidance includes management techniques on how continued disposal can be phased with optimum wildlife use. Once again, the key is a sound management plan.

Opinions on island need

While research focused primarily on wetland and upland habitats, aquatic or submerged habitats were also included. A literature review and a small field test were accomplished, but these concluded only that it is a promising but unproven disposal alternative. It was demonstrated that seagrasses can be transplanted to a disposal site; however, much additional information will be needed before the basic requirements for establishing a successful seagrass meadow are recognized and understood.

Aquatic habitat development

Productive Uses

Productive-use concepts

The fourth major part of the DMRP was the development and testing of concepts for nonwildlife-oriented beneficial or productive uses of either dredged material itself or disposal sites. Perhaps more than in any other alternative, successful use of the material or the sites as a natural resource requires a (sic) favorable and often fortuitous circumstances, but these do occur. Nontechnical factors outweigh technical ones more as a rule than as an exception and requirements for coordination and cooperation in land-use planning are extraordinary. Since many of the concepts are new and unusual, there is also the requirement for the Corps or some other group to take the initiative in promoting the ideas and getting people to think about them. Indeed the DMRP was a positive factor itself in advertising concepts and moderating apprehension by pointing out where others have applied the concepts successfully.

Promotion of ideas

Products development

Many products such as aggregate and bricks have been made using dredged material, sometimes successfully, and the potential for new concepts is limited only by the breadth of one's imagination. However, success will be difficult in view of the quality and undependability of the supply of the raw material, the requirements for capital investment, and especially the need for favorable market conditions. The only concept with apparent potential for at least regional application that was field-tested as part of the DMRP was the use of conventional disposal sites for the mariculture of shrimp. This was proven technically feasible and has caught the attention of some private entrepreneurs who feel the potential market outweighs the risk. In this and similar concepts, the advantage is that a landowner is more likely to favorably consider the use of his land as a disposal site if he can derive some benefit from it rather than relegate it solely to a form of waste disposal. In mariculture, the disposal site forms the required impoundment and the organic-rich dredged material is a periodically renewed source of food for the organisms.

Mariculture feasibility

Inland transport

Opportunities for the productive use of dredged material increase appreciably as one moves inland from navigable waterways. As a consequence, a study considered multiple aspects of modes of long-distance transport of dredged material and produced a method to use in determining the feasibility and cost of various transport systems for individual projects. If dredged material can be moved economically over distances of tens of miles, some of the disposal opportunities that emerge include improvement of agricultural soils, use of dredged material

Productive-use possibilities

in solid waste management, the filling of abandoned pits and quarries, and strip mine reclamation. Reports were prepared on multiple aspects of each of these possibilities, documenting requirements and discussing case histories as well as setting forth specific concept options.

Concern over contaminants

As would be expected, concerns over the effects of using chemically contaminated materials dominate the list of relevant considerations; however, so far these have not proven to be limiting. One should never lose sight of the fact that much dredged material is not contaminated, nor should one overlook the real dangers of placing saline dredged material in freshwater areas.

Recreational land use

Considering productive uses of dredged material, the obvious value of the land created when a disposal site reaches capacity was not overlooked. Most disposal sites filled with fine-grained materials from maintenance dredging are not suitable for industrial or commericial development from a foundation engineering point of view, but they can be ideally suited for recreational development. While it is not the present policy of the Corps to expand its role in recreation to include navigation projects, there is a need for recreational facilities in this context and many non-Federal groups are interested. One study pointed out the issues related to such use of disposal sites, including funding availability, maintenance responsibility, and guarantees of public land use. Another analyzed case histories in an attempt to find out why certain productive land uses have succeeded and others have failed. These include but are not limited to recreational uses. Other studies evaluated laws and regulations at all levels impacting on land uses and determined the land values and associated benefits created by disposal sites. The end products are guidelines on how the Corps or other groups can achieve or promote the productive subsequent uses of disposal sites both for the inherent benefit of doing so and the probability of being able to acquire new sites more easily.

Case history analysis

Summary

In summary, the DMRP contributed considerable new information that is being and can be used in all aspects of dredging project design and implementation, including project planning, engineering design, environmental impact assessment, project scheduling and operations, and permit evaluation. In other instances it only affirmed what had been previousy held by many, but it has done so in such a way as to reduce remaining doubt and enhance more widespread acceptance. In both cases, the result has been greatly increased opportunity for economically necessary waterways and harbors maintenance and development to proceed in harmony with appropriate levels of environmental protection and even enhancement in some cases.

Appendix 3

ONTARIO MOE AND U.S. EPA REGION V DREDGED SEDIMENT GUIDELINES

A. ONTARIO MINISTRY OF THE ENVIRONMENT

EVALUATING THE IMPACT OF MARINE CONSTRUCTION ACTIVITIES ON WATER RESOURCES (1976)

MARINE CONSTRUCTION GUIDELINES

Dredging

Each proposal to dredge will be reviewed for its water quality implications with consideration being given to the following factors:

a) Physical, chemical and biological quality of material to be dredged.
b) Quantity of material to be dredged.
c) Location and dredging site in relation to other water users (including fish and wildlife habitat).
d) Physical characteristics of the watercourse, such as depth and currents.
e) Time of year.
f) Duration of dredging.
g) Type of equipment to be used in dredging.
h) Existing quality of water in the vicinity of the dredging site.
i) Frequency of maintenance dredging.

Spoils Disposal in Open Water

Each proposal for open water disposal of dredged spoils will be reviewed for its water quality and use implications with consideration being given to the following factors:

a) Physical, chemical and biological quality of the dredged spoils.
b) Quantity of material to be dredged.
c) Location of the disposal site in relation to other waterusers (including fish and wildlife).
d) Physical characteristics of the watercourse at the disposal site such as depth and currents.
e) Existing and potential quality and use of the water in the disposal area.
f) Existing quality of the sediments in the disposal area.
g) Type of equipment to be used in transporting the spoils to the disposal area and method of deposition of the spoils.
h) Duration of disposal operations.
i) Frequency of use of disposal site.
j) Past history of spoils in the area.
k) Time of year.

Parameter Levels

The following parameter levels given in % dry weight and mg/g are used as guidelines* to suggest that contamination of the material to be dredged has occurred.

PARAMETER	LEVELS % DRY WT.	LEVELS mg/g
Percent loss on ignition at 600°C (Organic Content)	6.0	
Chemical Oxygen Demand (COD)	5.0	50
Total Kjeldahl Nitrogen (as N)	0.2	2
Total Phosphorus (as P)	0.1	1
Oil and Grease (ether or chloroform solubles)	0.15	1.5
Total Mercury	0.00003	0.3 μg/g

Even though sediments may have concentrations of the parameters lower than the stated guidelines, they may be deemed unsuitable for open water disposal on the basis of one or more of the following tests: settleability, sulphides, trace metals (including but not limited to iron, cadmium, lead, copper, zinc, chromium, arsenic, and nickel), pesticides and bioassay test for toxicity. Conversely, sediment with higher levels may be suitable for open water disposal in some circumstances. Since sediment quality is only one factor considered in spoils disposal. (sic) It is possible that dredged material meeting all of the above quality requirements will be rejected for open water disposal based on review of the other factors outlined previously in the Spoils Disposal in Open Water Section.

Spoils Disposal on Land or in Dyked Areas

Each proposal to dispose of dredged spoils on land or in dyked areas will be reviewed for its water quality implications with consideration being given to the following factors:

a) Adequacy of dyked structure to contain spoils under forces of lateral pressure, seepage, and/or erosion. (This does not imply that the Ministry is responsible for the structural integrity of dykes, etc.).

b) The quality and quantity of any supernatant draining to a watercourse.

c) Adequancy of native soils for containment of contaminants (including protection of groundwater quality).

In some instances, treatment of the supernatant from a disposal area may be required. This treatment could be physical (settling or filtration),

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*These guidelines are continually reviewed in the light of data being obtained from dredging projects on water quality and water use effects and in light of new information in the literature.

chemical (coagulation and flocculation or precipitation), biological (activated sludge), or a combination of these.

Where the disposal area is a new fill site at the water's edge the factors listed for Placing Fill, should be considered.

Proponents are advised that the Ministry of the Environment has special regulations governing on-land disposal of contaminants including a formalized permit system (Sanitary Landfill Permits).

Dredge Spoils Disposal Within Containment Facilities

The following points may be considered aids in evaluating dyked disposal. The recommendations are not to be construed as factors that would guarantee the structural integrity of dykes or dyked areas. These are not substitutes for sound engineering design and management.

A containment area for spoils disposal should provide: retention of the spoil solids and contaminants within the designated confines so that it will not re-enter any watercourse or cause detriment to adjacent areas and allow only water of acceptable quality to return to the watercourse.

PRELIMINARY CONSIDERATIONS

a) Any area selected as potential containment area should be thoroughly investigated for compatibility with existing and proposed uses.

b) Dyke design should be based on adequate soil, subsurface and stability analyses.

c) Dyke design and construction should be such that the dyke is safe and stable under all construction and operational phases of the disposal area.

d) Containment areas to be built on marshy or other wetland areas should be fully approved by the Ontario Ministry of Natural Resources or other appropriate agency.

e) Where necessary, prior approval must be guaranteed the proponent with regards to easement access or use of waterlots.

f) In areas where dyke failure could cause irreparable damage, precautionary measures should be formulated well ahead of the actual disposal operation to deal with any emergency.

CAPACITY CONSIDERATIONS

a) The dykes and dyked area should be constructed such that at any given time it will provide sufficient retention time so that particulate matter may settle out.

In considering the capacity requirements allowances should be made for:

- possible over dredging (i.e., where slightly greater than anticipated volume of material is removed);
- expansion of dredged material (excavated vs in situ volume);
- rate of dredging;
- the detention time required for adequate settling;
- rate of seepage (where allowed) through dykes; and,
- runoff of effluent of acceptable quality.

b) Provisions must be made for foundation and embankment settlement to ensure adequate freeboard to prevent overtopping by waves.

DESIGN AND CONSTRUCTION CONSIDERATIONS

a) Trees, stumps, etc. in the path of the dykes should normally be cleared and grubbed.

b) Subsurface conditions should indicate the need for overburden or organic material removal.

c) Access roads should be clearly defined and adjacent areas should not be subjected to unnecessary traffic or trampling.

d) The design features of the dyke must be such that it will not impose excessive stresses upon the foundation.

e) The slopes of the dykes must be stable under all construction and operational conditions.

f) Dyke design should incorporate features that would minimize possible failures due to sinking or spreading.

g) i) Dykes built on shore close to rivers or streams should be located such that they will not result in later displacement of the river or stream bank.

ii) Although not normally condoned, the dyke or containment area built into a watercourse should not restrict natural streamflow to the degree that upstream water levels will be raised or back waters created.

h) Use of heavy construction machinery should be restricted as much as possible to areas directly associated with the project.

i) In instances where equipment other than pipeline dredges are to be used, necessary additional facilities must be constructed, e.g., adequate mooring facilities for direct pumpout from hopper dredges, etc.

OPERATIONAL CONSIDERATIONS

a) The diameter of the inflow pipeline or the rate of pumping should be such that the rate of discharge would allow adequate retention.

b) The discharge end of the pipeline should be located in such a manner that incoming material would not cause local scour of dyke or build-up material near sluice.

c) The outlet sluice should be located such that there will be no short-circuiting of flow from the inlet.

d) Where feasible the outlet sluice(s) should be located so as to take advantage of any prevailing wind to push turbid waters away from outlet.

EFFLUENT QUALITY CONSIDERATIONS

a) If possible, adjustable weirs should be used instead of simple outfall pipes to provide adequate detention time and water quality control.

b) Where feasible, a layer of low cover vegetation should be left intact between the outfall and receiving water course to provide additional entrapment of particles in the effluent.

c) In instances where the water within the containment area contain floating debris or surface films, skimming devices should be installed along the sluice.

d) Highly contaminated dredge spoil should be controlled with regards to quality of seepage and groundwater contamination.

e) In cases where effluent from an outfall enters a ditch, prior to the watercourse proper, the ditch should be protected as necessary to prevent scouring and turbidity production.

f) Depending on the severity of the problem, especially with colloidal particles, where conventional settling procedures are not adequate, consideration should be given to the use of additional treatment methods such as chemical coagulation, etc. Where necessary to guarantee effluent of acceptable quality, the containment area must be provided with multiple settling basins.

g) Water quality of the effluent shall be such that the MOE "criteria" for the receiving stream are not violated. (See MOE Guidelines and Criteria for Water Quality Management in Ontario.)

MAINTENANCE CONSIDERATION

a) The passage of seepage flow through the dyke and foundations must be controlled so that piping, sloughing and removal of material by solution do not occur.

b) Measures must be taken to stabilize the following conditions:

Cracks in slopes, bulging and slumping of slopes; excessive pore pressure; wet spots and seepage on outer slope; erosion of slope protection; and excessive settlement of dyke foundation.

FWPCA CHICAGO AUGUST 1968

DEGREE OF POLLUTION OF HARBOUR SEDIMENTS (mg/kg DRY WT.)

PARAMETER	LIGHT	MODERATE	HEAVY
Ammonia N	0-25 mg/kg	25-75	over 75
COD	0-40,000	40,000-120,000	over 120,000
Total Iron	0-8,000	8,000- 13,000	over 13,000
Lead	0-40	40-60	over 60
Oil & Grease	0-1,000	1,000-2,000	over 2,000
Phenol	0-0.26	0.26-0.60	over 0.60
Total Phosphorus	0-100	100-300	over 300
Sulphide	0-20	20-60	over 60
% Volatile Solids	0-5%	5-8%	over 8%
Zinc	0-90	90-200	over 200

Following essentially the same procedure, the Cleveland FWPCA office published a table in March 1969, to indicate what would be unacceptable for dumping in Lake Erie.

FWPCA CLEVELAND 1969

SEDIMENT CHEMICAL CRITERIA - NOT ACCEPTABLE WHEN ONE OR MORE EXCEEDS THE FOLLOWING LIMITS (FOR DUMPING IN LAKE ERIE)

Chlorine demand	15 mg/g dry wt.
COD	100 "
BOD_5	10 "
Volatile Solids	100 "
Oil & Grease	10 "
Phosphorus	1.5 "
Nitrogen	3.0 "
Iron	50 "

By 1971 these tables had been combined as the Jensen criteria and adopted by the new Environmental Protection Agency (EPA) for use across the nation in either fresh or marine waters, to determine the suitability of open water spoils disposal as shown below:

EPA 1971

When concentrations, in sediments, of one or more of the following pollution parameters exceed the limits expressed below, the sediment will be considered polluted in all cases and, therefore, unacceptable for open water disposal.

SEDIMENTS IN FRESH AND MARINE WATERS	CONCENTRATION IN % (DRY WT. BASIS)
*Volatile Solids	6.0
Chemical Oxygen Demand (COD)	5.0
Total Kjeldahl Nitrogen	0.10
Oil & Grease	0.15
Mercury	0.0001
Lead	0.005
Zinc	0.005

In the early 1970's the Ontario Water Resources Commission (OWRC) drafted guidelines for "The Review of Proposed Dredging & Spoils Disposal Operations". The parameter levels selected by the OWRC to evaluate dredging projects were modified from the American criteria to reflect our own experience with sediment data from Canadian harbours on the Great Lakes. In the case of mercury, the guideline was based not on a correlation with impaired water quality or benthos but an apparent correlation with mercury in fish levels higher than the 0.5 ppm guideline for human consumption. The Ontario practice differed significantly from the stated American practice in that disposal operations were not rejected out of hand merely because one parameter in one sample exceeded the guidelines. In Ontario each project is considered on a case-by-case basis and some flexibility is allowed according to local conditions and the nature of the project under evaluation. The factors to be considered in an evaluation were formalized with the publication in January 1976, of the MOE document "Evaluating Construction Activities Impacting on Water Resources". MOE has been using the following parameter levels as guidelines to suggest that contamination has occurred.

PARAMETER	% DRY WT.
Percent loss on ignition at $600^{o}C$ (Organic Content)	6.0
Chemical Oxygen Demand (COD)	5.0
Total Kjeldahl Nitrogen (as N)	0.2
Total Phosphorus (as P)	0.1
Oil & Grease (ether or chloroform solubles)	0.15
Total Mercury	0.00003

Several limitations exist to prevent application of these guidelines as absolute criteria.

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*When analysing sediments dredged from marine waters, the following correlation between volatile solids and COD should be made:

$$T.V.S.\ \%\ (dry) = 1.32 + 0.98\ (COD\ \%)$$

If the results show a significant deviation from this equation, additional samples should be analysed to insure reliable measurements.

1) The guidelines are based on a bulk sediment analysis. Changes in substrate type may dramatically change the concentration of contaminants without necessarily indicating any additional contaminant input, simply because contaminants are associated primarily with the fines (clay size fraction).

2) The individual parameter levels are empirically derived and relate more to some incremental change above background levels for the nearshore zone of the Great Lakes, than to a level related to known adverse effects on biota. Most of the parameters have been selected on the basis of harbour studies, where they appear together with a large number of other chemicals in known and unknown quantities, so that the synergistic effects between parameters are not adequately understood.

3) Individual parameter levels may be exceeded under natural conditions e.g., organic content in marsh sediments, metals in some areas of mineralization. Sufficient sampling should be undertaken to establish local background conditions.

4) The importance of sediment chemistry in bioaccumulation of trace contaminants is poorly understood. Direct uptake of PCBs and mercury has been demonstrated from sediments to fish under lab conditions but the factors influencing the rates of uptake have not yet been quantified.

The International Joint Commission (IJC) has recommended the establishment of compatible criteria between Canada and the United States to designate contaminated sediments. While this may provide the necessary stimulus for research to overcome the limitations mentioned above, it would be unrealistic to assume that fixed numerical criteria will have universal applicability in this complex field.

Region V of the U.S. EPA has reverted to a set of figures to express ranges of pollution as shown below:

EPA 1977 GUIDELINES
FROM IJC UPPER LAKES REPORT APPENDIX C

FIGURE 1: RANGES USED TO CLASSIFY SEDIMENTS FROM GREAT LAKES HARBOURS. ALL RANGES IN mg/kg DRY WT UNLESS OTHERWISE NOTED.

	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
Volatile Solids	<5%	5% - 8%	>8%
COD	<40,000	40,000-80,000	>80,000
TKN	<1,000	1,000-2,000	>2,000
Oil & Grease (Hexane Solubles)	<1,000	1,000-2,000	>2,000
Lead	<40	40-60	>60
Zinc	<90	90-200	>200
Mercury	<1.0	N.A.	>1.0

FIGURE II: SUPPLEMENTARY RANGES (POORER DATA BASE) USED TO CLASSIFY SEDIMENT FROM GREAT LAKES HARBOURS. ALL RANGES IN mg/kg DRY WEIGHT UNLESS OTHERWISE NOTED

	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
Ammonia	<75	75-200	>200
Cyanide	<0.10	0.10-0.25	>0.25
Phosphorus	<420	420-650	>650
Iron	<17,000	17,000-25,000	>25,000
Nickel	<20	20-50	>50
Manganese	<300	300-500	>500
Arsenic	<3	3-8	>8
Cadmium	*	*	>6
Chromium	<25	25-75	>75
Barium	<20	20-60	>60
Copper	<25	26-50	>50

*Lower limits not established

PROCEDURES

Proposals for dredging and open water disposal will be evaluated on a site specific basis. Major emphasis will be placed on the possible effects of the proposal on water quality and water use in the area.

CLEAN SPOILS

Spoils resulting from capital works (i.e., areas not previously dredged) will in many instances be suitable for open water disposal as far as contaminant levels are concerned. The material from such projects commonly includes clean littoral drift sands, boulders, blasted rock and clay till. If no water quality or water use impairment will result the material may be placed in open water at a site where the spoils generally match the substrate. In some cases it may be possible to locate disposal sites for clean, coarse material that would enhance fish habitat. Littoral drift sands should be placed on the downdrift beach wherever possible to minimize erosion.

CONTAMINATED SPOILS

Spoils that exceed the MOE sediment quality guidelines in any parameter may be unsuitable for open water disposal, based on water quality or water use or public health reasons. Such material which usually results from maintenance dredging (e.g., harbours, etc.) must be confined within dyked areas or disposed of upland so as to prevent entry to a watercourse. The degree of confinement may be varied to suit the contaminant. For example, no escape of toxic PCBs should occur, but it may be sufficient to filter out wood fibre through porous berms.

B. U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V,
CHICAGO, ILLINOIS
APRIL 1977

GUIDELINES FOR THE POLLUTIONAL CLASSIFICATION OF GREAT LAKES HARBOR SEDIMENTS

Guidelines for the evaluation of Great Lakes harbor sediments, based on bulk sediment analysis, have been developed by Region V of the U.S. Environmental Protection Agency. These guidelines, developed under the pressure of the need to make immediate decisions regarding the disposal of dredged material, have not been adequately related to the impact of the sediments on the lakes and are considered interim guidelines until more scientifically sound guidelines are developed.

The guidelines are based on the following facts and assumptions:

1. Sediments that have been severely altered by the activities of man are most likely to have adverse environmental impacts.

2. The variability of the sampling and analytical techniques is such that the assessment of any sample must be based on all factors and not on any single parameter with the exception of mercury and polychlorinated biphenyls (PCBs).

3. Due to the documented bioaccumulation of mercury and PCBs, rigid limitations are used which override all other considerations.

Sediments are classified as heavily polluted, moderately polluted, or nonpolluted by evaluating each parameter measured against the scales shown below. The overall classification of the sample is based on the most predominant classification of the individual parameters. Additional factors such as elutriate test results, source of contamination, particle size distribution, benthic macroinvertebrate populations, color, and odor are also considered. These factors are interrelated in a complex manner and their interpretation is necessarily somewhat subjective.

The following ranges used to classify sediments from Great Lakes harbors are based on compilations of data from over 100 different harbors since 1967.

	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
Volatile Solids (%)	<5	5 - 8	>8
COD (mg/kg dry weight)	<40,000	40,000-80,000	>80,000
TKN " " "	<1,000	1,000-2,000	>2,000
Oil & Grease (Hexane Solubles) (mg/kg dry weight)	<1,000	1,000-2,000	>2,000
Lead (mg/kg dry weight)	<40	40-60	>60
Zinc " " "	<90	90-200	>200

The following supplementary ranges used to classify sediments from Great Lakes harbors have been developed to the point where they are usable but are still subject to modification by the addition of new data. These ranges are based on 260 samples from 34 harbors sampled during 1974 and 1975.

	NONPOLLUTED	MODERATELY POLLUTED (mg/kg dry weight)	HEAVILY POLLUTED
Ammonia	<75	75-200	>200
Cyanide	<0.10	0.10-0.25	>0.25
Phosphorus	<420	420-650	>650
Iron	<17,000	17,000-25,000	>25,000
Nickel	<20	20-50	>50
Manganese	<300	300-500	>500
Arsenic	<3	3-8	>8
Cadmium	*	*	>6
Chromium	<25	25-75	>75
Barium	<20	20-60	>60
Copper	<25	25-50	>50

*Lower limits not established

The guidelines stated below for mercury and PCBs are based upon the best available information and are subject to revision as new information becomes available.

Methylation of mercury at levels ≥ 1 mg/kg has been documented (1,2). Methyl mercury is directly available for bioaccumulation in the food chain.

Elevated PCB levels in large fish have been found in all of the Great Lakes. The accumulation pathways are not well understood. However, bioaccumulation of PCBs at levels ≥ 10 mg/kg in fathead minnows has been documented (3).

Because of the known bioaccumulation of these toxic compounds, a rigid limitation is used. If the guidelines values are exceeded, the sediments are classified as polluted and unacceptable for open lake disposal no matter what the other data indicate.

	POLLUTED
Mercury	≥ 1 mg/kg dry weight
Total PCBs	≥ 10 mg/kg dry weight

The pollutional classification of sediments with total PCB concentrations between 1.0 mg/kg and 10.0 mg/kg dry weight will be determined on a case-by-case basis.

Elutriate Test Results

The elutriate test was designed to simulate the dredging and disposal process. In the test, sediment and dredging site water are mixed in the ratio of 1:4 by volume. The mixture is shaken for 30 minutes, allowed to settle for one hour, centrifuged, and filtered through a 0.45 µ filter. The filtered water (elutriate water) is then chemically analysed.

A sample of the dredging site water used in the elutriate test is filtered through a 0.45 μ filter and chemically analysed.

A comparison of the elutriate water with the filtered dredging site water for like constituents indicates whether a constituent was or was not released in the test.

The value of elutriate test results are limited for overall pollutional classification because they reflect only immediate release to the water column under aerobic and near neutral pH conditions. However, elutriate test results can be used to confirm releases of toxic materials and to influence decisions where bulk sediment results are marginal between two classifications. If there is release or non-release, particularly of a more toxic constituent, the elutriate test results can shift the classification toward the more polluted or the less polluted range, respectively.

Source of Sediment Contamination

In many cases the sources of sediment contamination are readily apparent. Sediments reflect the inputs of paper mills, steel mills, sewage discharges, and heavy industry very faithfully. Many sediments may have moderate or high concentrations of TKN, COD, and volatile solids yet exhibit no evidence of man-made pollution. This usually occurs when drainage from a swampy area reaches the channel or harbor, or when the project itself is located in a low lying wetland area. Pollution in these projects may be considered natural and some leeway may be given in the range values for TKN, COD, and volatile solids provided that toxic materials are not also present.

Field Observations

Experience has shown that field observations are a most reliable indicator of sediment condition. Important factors are color, texture, odor, presence of detritus, and presence of oily material.

COLOR

A general guideline is the lighter the color the cleaner the sediment. There are exceptions to this rule when natural deposits have a darker color. These conditions are usually apparent to the sediment sampler during the survey.

TEXTURE

A general rule is the finer the material the more polluted it is. Sands and gravels usually have low concentrations of pollutants while silts usually have higher concentrations. Silts are frequently carried from polluted upstream areas, whereas, sand usually comes from lateral drift along the shore of the lake. Once again, this general rule can have exceptions and it must be applied with care.

ODOR

This is the odor noted by the sampler when the sample is collected. These odors can vary widely with temperature and observer and must be used carefully. Lack of odor, a beach odor, or a fishy odor tends to denote cleaner samples.

DETRITUS

Detritus may cause higher values for the organic parameters COD, TKN, and volatile solids. It usually denotes pollution from natural sources. (Note: The determination of the "naturalness" of a sediment depends upon the establishment of a natural organic source and a lack of man-made pollution sources with low values for metals and oil and grease. The presence of detritus is not decisive in itself.)

OILY MATERIAL

This almost always comes from industry or shipping activities. Samples showing visible oil are usually highly contaminated. If chemical results are marginal, a notation of oil is grounds for declaring the sediment to be polluted.

Benthos

Classical biological evaluation of benthos is not applicable to harbor or channel sediments beause these areas very seldom support a well balanced population. Very high concentrations of tolerant organisms indicate organic contamination but do not necessarily preclude open lake disposal of the sediments. A moderate concentration of oligochaetes or other tolerant organisms frequently characterizes an acceptable sample. The worst case exists when there is a complete lack or very limited number of organisms. This may indicate a toxic condition.

In addition, biological results must be interpreted in light of the habitat provided in the harbor or channel. Drifting sand can be a very harsh habitat which may support only a few organisms. Silty material, on the other hand, usually provides a good habitat for sludgeworms, leeches, fingernail clams, and perhaps, amphipods. Material that is frequently disturbed by ship's propellers provides a poor habitat.

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Appendix 4

WATER QUALITY BOARD AND RESEARCH ADVISORY BOARD COMMENTS ON DREDGING

A. WATER QUALITY BOARD

Dredging

The International Working Group on the Abatement and Control of Pollution from Dredging Activities was established in 1972, pursuant to Annex 6 of the Agreement. Its final report was submitted to the Governments in May, 1975.

The Working Group was directed to review dredging practices and programs in the Great Lakes as well as the relevant laws and regulations governing dredging. The intent was to develop compatible criteria for the characterization of dredged material and to recommend compatible programs governing the disposal of polluted spoil in open waters.

The Working Group concluded that there are no single parameter values which could be adopted as universal criteria for designating "polluted dredged spoils" applicable throughout the Great Lakes. It recommended a site-specific assessment of the hazards and potential benefits of each project within its particular environment through a selection of indicator parameters derived from baseline information on water and sediment quality and known sources of potential contaminants. Moreover, the Working Group recommended that guidelines on dredging be accomplished by administrative action to allow some flexibility in meeting the changing responsibilities of different agencies and jurisdictions.

The report also advised that a standing committee be formed to audit dredging activities in the Great Lakes and review assessments of individual projects to ensure compliance with recommended guidelines. Such a committee would provide a logical focus for encouraging the exchange of information from continuing research activities and accumulated experience and would be able to recommend appropriate changes in criteria and guidelines to reflect technological advances as they occur.

The Board was disappointed that the Working Group was unable to recommend universal criteria for designating polluted dredge spoils, rather than the site-specific assessment which the Board considers unduly burdensome to regulatory agencies. However, if the standing committee as proposed by the Working Group is established under the IJC, as the Board recommends, the Board would encourage furher examination of the two approaches by the standing committee.

Source: Water Quality Board, Great Lakes Water Quality 1975 Annual Report p. 105

B. RESEARCH ADVISORY BOARD

DEPOSITION OF TOXIC SUBSTANCES IN THE GREAT LAKES

Although it is desirable that harmful persistent organic contaminants and heavy metals be substantially absent from the waters of the Great Lakes, the fact is that many such substances are present due to previous inadequate control measures. Various concentrations are found in water, biota, and Great Lakes sediments.

With regard to sediments, the Board in its 1977 report to the International Joint Commission, stated:

> "that more effort must be devoted to ascertaining the permanency of toxic materials in the sediments, and whether these sediment sources can be safely ignored or if they must be considered as sources contributing to the biologically available concentrations in the water."

In the past year, the Board's Expert Committee on Engineering and Technological Aspects of Great Lakes Water Quality, illustrated the significance of the Board's concerns during its review of current dredged material disposal practices in the Great Lakes.

Great Lakes dredging involves the removal of lake sediments from the bottom of a waterway to form a channel of sufficient depth and width to accommodate barges and ships within the lakes. In 1966, the U.S. Army Corps of Engineers began a study of the effects of, and alternatives to, dumping dredged material from the Great Lakes harbors into the lakes. The study was initiated because of concerns that increased population and industrial development on the Great Lakes were causing the sediments in channels to become increasingly polluted.

In 1969, the Corps' Buffalo District issued a report on this study which stated that no harmful effects attributable to open water disposal had been identified, but that the possibility of environmental damage existed. The report concluded that in-lake disposal of heavily polluted dredged material must be considered presumptively undesirable, and that it might be desirable to construct diked areas to confine materials to be dredged over a 10-year period from 35 Great Lakes harbors which were considered highly polluted. The assumption was that after a 10-year period, sufficient progress would have been made under regulatory programs for controlling the entry of pollutants to permit a resumption of open-water dumping without serious environmental risks. The United States Congress responded to this recommendation by enacting Section 123 of the River and Harbor Act of 1970. It authorized the Corps to build, operate, and maintain confined disposal facilities for polluted dredged material on the Great Lakes. The Act also authorized EPA to advise the Corps as to which localities were in the greatest need of these facilities.

Source: Research Advisory Board's Annual Report, (July 1978), pp. 14-17

These measures were taken because of the uncertainty as to whether open-water disposal of dredged materials would facilitate the release of contaminants from the polluted dredged material. From the time of authorization of the confined disposal program in 1970 to February 1977, its estimated total cost was 263 million dollars. The disposal cost was conservatively estimated to be 350 percent greater than if open-lake disposal was practised. In addition, annual maintenance costs of 10-20 million dollars are encountered. It is nonetheless, difficult to comment on the additional costs of confined disposal because some of these confined disposal costs may have resulted in beneficial uses, such as marsh and park development.

Since the publication of the 1975 report of the International Working Group on Abatement and Control of Pollution from Dredging Activities, considerable research on the effects of dredging and dredged material research has been completed. In particular, the United States Army Corps of Engineers as of March 1978, completed a 32 million dollar Dredged Material Research Program. The Board's Expert Committee on Engineering and Technological Aspects, therefore, appointed a Subcommittee to meet with representatives of key agencies and research groups to appraise the state-of-the-art on the abatement and control of pollution from dredging activities. In general, several related observations are forwarded for the Commission's information:

1. To determine which dredged materials are "polluted" and subsequently subject to confined disposal sites, the responsible Great Lakes jurisdictions use criteria which are based on bulk analyses of the material. That is, the material is digested and analysed for its total composition with regard to various chemical constituents. This approach assumes that <u>all</u> contaminants with the dredged material can be available to the environment. It was further noted that the two countries have different decision levels for mercury and PCB concentrations in dredged materials.

2. The results of the Corps of Engineers Dredged Material Research Program have shown no relationship between bulk chemical content of a sediment and the adverse effect that may result from open-water disposal of that sediment. Elutriate tests and bioassay procedures appear to be more useful in evaluating the potential environmental impact of dredged material disposal. In other words, dredged material may be classified as "polluted" on the basis of bulk analyses, while in fact few of the contaminants may be available to the environment.

3. In recognition of the Corps of Engineers results, at least one Great Lakes agency with responsibility for classifying dredged materials noted that case-by-case assessments using elutriate tests and bioassay procedures are beyond the present resources allocated to their agencies for classifications of dredged material. The additional resources required would be of minimal cost when compared to the United States 263 million dollar cost of confined disposal in the Great Lakes during the past seven years. Subsequent inquiries have indicated that as of this date, 8 of 10 U.S. EPA Regions have now adopted or are considering adopting case-by-case evaluation of dredged materials.

4. There is increasing evidence that the so-called "confined disposal" of dredged sediments currently practised in the Great Lakes area may have greater adverse environmental impact than originally perceived, and possibly this impact may be as or more significant than the less expensive open-water disposal. Several reasons are possible including: inappropriate management and design of such disposal sites; overflow of excess water to nearshore areas of the lakes and subsequent dispersal of contaminants which are associated with microparticulate materials; and, the different physical-chemical conditions within land sites which may enhance mobilization of contaminants.

5. The Corps studies have thus far indicated the virtual absence of significant biological short and long-term effects associated with open-water dumping. The prime effects in the short-term were physical, by smothering of fish spawning beds or bottom dwelling organisms. Effects on the latter were minimized when dredged materials were deposited on similar materials in the lake bottom (i.e. sand on sand, or, mud on mud).

In view of the recent research results, it is possible that disposal practices in the Great Lakes Basin may have cost both Governments considerably more than necessary because of the criteria used in classifying dredged materials and that there may be significant potential environmental impacts from "confined disposal" sites. Therefore, there is a need for an immediate and careful review of the existing management policies for dredging and dredged material disposal in the Great Lakes Basin with regard to the recent research results.

RECOMMENDATIONS

The Great Lakes Research Advisory Board recommends that the International Joint Commission:

1. Request Governments to assure coordinated efforts in both countries to identify existing data bases and to develop new data bases with information on physical, chemical and toxicological data, to enable assessment of chemicals. The Board offers the suggestion of utilizing United States and Canadian national correspondents to the International Register of Potentially Toxic Chemicals of the United Nations Environment Program, for coordination.

2. Recommend an immediate joint United States-Canada effort to review and assess alternative dredged material disposal policies in the Great Lakes Basin. The assessment should be based on the intensive and recently completed Canadian and United States research efforts. If no mechanism is available under the current or the future revised Agreement, the Board is willing to organize a task force to undertake this effort.

3. Express to the Government of Canada its concern on the limitations of the Canada Environmental Contaminants Act to control and prevent future manifestation of man-made chemicals within Canada and the

Great Lakes ecosystem because of the inability of the Act to assure that the Departments, with responsibility for enforcement of the Act have access to information which will identify all substances in use, manufactured or imported within Canada.

4. There is growing evidence that the so-called "confined disposal" of [illegible] may [illegible] received, and possibly this impact may be as or more significant than the less expensive open-water disposal. Several reasons are possible including: inappropriate management and design of such disposal sites; overflow of excess water to nearshore areas of the lakes and subsequent dispersal of contaminants which are associated with microparticulate materials; and, the different physical-chemical conditions within land sites which may enhance mobilization of contaminants.

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Appendix 5

GREAT LAKES WETLANDS - LEGISLATION AND DREDGING IMPACTS

LEGISLATION

United States

Various policies and legislation exist in the United States and address wetlands. This section focuses on regulatory programs, including state permit programs, that can be applied to wetlands.

Federal

Federal Water Pollution Control Act of 1972 set up a permit program under Section 404 which includes controls on the dredging and filling of wetlands, designating the Army Corps of Engineers as the lead agency. The Clean Water Act of 1977 amended Section 404, giving the states authority to take over the permit program. At this time, no state has exercised this option. Section 10 of the River and Harbors Act of 1899 gives the Army Corps of Engineers permit authority to regulate any work in navigable waters of the United States.

Illinois

State dredge and fill permits for activities in navigable waters within Port Districts are issued by Regional Port Districts. The Illinois Department of Transportation issues permits for these activities in public waters of the state (Illinois Annotated Statutes, Chapter 19, Section 65). The state also issues permits regulating floodplain development (Illinois Annotated Statutes, Chapter 19, Section 65(F)).

Indiana

The state has a permit system that regulates all activity in lakes and on shorelines at or below mean sea level, administered by Indiana Department of Natural Resources (Indiana Code, Section 13-2-11 (Lakes Law)). This department also issues permits controlling activities within floodplain areas (Indiana Code, Section 13-2-22 (Flood Control Act)).

Michigan

Michigan Department of Natural Resources (MDNR) issues permits for any activity below ordinary high water on inland lakes and streams (Michigan Comp. Laws Ann. Sections 281.951-281.965 (Inland Lakes and Streams Act)). MDNR also has the authority to regulate activity on public trust lands below ordinary high water on the Great Lakes (Michigan Comp. Laws Ann. Sections 322.709, 16.352, 24.102, 24.104 (Great Lakes Submerged Lands Act)). The state establishes comprehensive use and management plans for shorelands (Michigan Act Comp. Laws Ann. Sections 281.631 - 281.645 (Shorelands Protection and Management)). The state issues permits regulating activity in floodplains (Michigan

Comp. Laws Ann. Sections 323.56, 560.117). A recently passed act "provides for the preservation, management, protection and use of wetlands, to require permits to alter certain wetlands; and to provide remedies and penalties" (Act No. 203, Public Acts of 1979 (The Goemaere-Anderson Wetlands Protection Act)).

Minnesota

The Minnesota Department of Natural Resources regulates the use of all public waters by means of a permit program (Minnesota Statutes, Chapter 105). Critical areas, designated by the state, are regulated by issuance of development permits (Minnesota Statutes, Section 116G.01 - 116G.14). Counties are required to issue permits for shoreland zoning and floodplain development (Minnesota Statutes, Sections 105.485, 104.01-104.07).

New York

The New York Department of Environmental Conservation has the authority to issue permits regulating dredging and filling in areas influenced by tides (New York Environmental Conservation Law, Article 25). Local entities have the power to issue permits regulating dredging and filling in freshwater wetlands (New York Environmental Conservation Law, Article 36).

Ohio

Ohio has no state regulation of wetlands. The Ohio Department of Natural Resources has established a Critical Areas program, but the guidelines set forth are voluntarily adopted by communities wishing to regulate these areas.

Pennsylvania

The Pennsylvania Department of Environmental Resources has a permit program regulating the construction of dams and encroachment in all waters of the state (Pennsylvania Statutes Annotated Title 32, Sections 681-691).

Wisconsin

A comprehensive use and management plan for navigable waters and shorelands has been established by Wisconsin Department of Natural Resources (Wisconsin Statutes Annotated Sections 144,26, 59.971 (Shoreland Zoning Act)). The state sets standards for floodplain regulation, with the local entities adopting ordinances (Wisconsin Statutes Annotated Section 87.30 (Flood Plain Zoning Act)).

Canada

There are no specific policies and/or legislation directed to the preservation of wetland areas on the Canadian Great Lakes. There are, however, public acquisition programs and legislation which can be applied indirectly for wetland protection. Some of the more pertinent ones are as follows.

Federal

Migratory Birds Convention Act provides regulations for the protection of migratory birds, e.g. hunting seasons and permits. Only Section 35(1) of the Act deals with habitat disruption, i.e. "no person shall deposit or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migrating birds".

Canada Wildlife Act gives the federal government authority to acquire and manage habitats for migratory birds and, in agreement with provinces or territories, for other species of wildlife.

Fisheries Act provisions prohibit activities which result in the harmful alteration, disruption or destruction of fish habitat.

Ontario

Public Lands Act regulates land use planning on Crown lands.

Ontario Planning and Development Act can be used to apply land use designations on identified areas and require conformance of regional and municipal planning.

Conservation Authorities Act can control filling and construction on any area below the high water mark of a lake, river, creek or stream which falls under the jurisdiction of any of the provincial conservation authorities.

DREDGE AND FILL IMPACTS ON WETLANDS

Canada

The extent to which dredge and fill activities have contributed to the loss of wetland habitat on the Canadian Great Lakes is not clearly known. Certainly they have in the past contributed significantly to losses in certain areas, e.g. 27.7% of the wetlands of eastern Lake St. Clair have been lost during the period 1965-1978 (personal communication, G. McCullough, Canadian Wildlife Service). Existing areas of shoreline wetlands are shown in Table 1.

United States

While wetland acreages vary from state to state, the reasons for the losses are similar - draining, urban expansion, erosion and coastal flooding. Historical records have not been kept by most states to explain the losses; however, it appears that few losses are directly attributed to dredging activities.

Illinois

There are few wetlands that still exist along the Illinois shoreline, most having been drained, graded and paved prior to implementation of wetland regulations.

Indiana

There is still a significant amount of wetland area on the Lake Michigan shoreline; however, no actual acreage figure is available. It is estimated that possibly as much as 90% of the wetlands have been impacted by dredge and fill activities to varying degrees (personal communication, David Turner, Indiana Department of Natural Resources).

Michigan

The 1973 Shorelands Inventory showed 105,855 acres of wetlands existing along Michigan's shorelines as follows:

Lake Huron	39,107 acres
Lake Michigan	29,785 acres
Lake St. Clair (including St. Clair and Detroit Rivers)	17,050 acres
Lake Superior	13,198 acres
Lake Erie	6,715 acres

Source: Jaworski and Raphael; Coastal Wetlands Value Study. 1978.

Information such as acres lost or impact through dredging activities is not readily available.

Minnesota

Minnesota has few traditionally defined wetlands along the shoreline of Lake Superior. All dredged materials are disposed of in upland or confined sites, minimizing potential impacts to wetlands.

Ohio

An inventory conducted in 1974 showed approximately 15,000 acres of wetlands along Ohio's shoreline of Lake Erie (Weeks, 1974). It is estimated that over one-half of the coastal wetlands have been lost since 1954 (Ohio Coastal Zone Management Program, Public Review Draft, Spring 1979). No Ohio wetlands have been impacted through dredging activities in recent years.

Pennsylvania

The number of wetlands along Pennsylvania's Lake Erie shoreline is extremely limited. Only one major wetland has been identified. This area, approximately 1,800 acres, is on Presque Isle Peninsula. It is in a state park and thus protected from dredging impacts. Eleven other small wetlands have been identified and none of them are impacted through dredging activities (personal communication, E. J. Tabor, Pennsylvania Department of Environmental Resources).

New York

According to 1976 wetland inventory records, only one significant wetland exists along the Lake Erie shoreline. Coastal maps show primarily bluffs and drop-offs indicating that there were probably few wetlands ever associated with the lake. Historical trends of wetland losses have not been studied.

Wisconsin

Wetland acreages are available from past inventories, but these are statewide figures, e.g. it is estimated that southeastern Wisconsin had lost 61% of its marshes by 1968 (March, 1973). Losses are the greatest in urban areas, especially the Green Bay area. Most losses are attributable to agriculture and urban development.

March, J.H., G.F. Marte and R.A. Hunt. "Breeding Duck Populations and Habitat in Wisconsin". Wisconsin Department of Natural Resources. Technical Bulletin No. 68, 1973.

Weeks, J. L. Ohio Wetlands Inventory, Ohio Department of Natural Resources, 1974.

TABLE 1

WETLAND AREA OF THE CANADIAN LOWER GREAT LAKES BY WETLAND TYPE AND WATER BODY*

	OPEN SHORELINE	UNRESTRICTED BAY	SHALLOW-SLOPING BEACH	RIVER DELTA	RESTRICTED RIVERINE	LAKE CONNECTED INLAND	PROTECTED (BERMED or DYKED)	TOTAL
St. Clair River	89* (221)					6 (15)		95 (236)
Lake St. Clair	1,128 (2,788)			6,808 (16,824)	11 (28)		5,084 (12,563)	13,032 (32,203)
Detroit River	242 (600)	50 (123)			40 (98)		256 (633)	588 (1,454)
Lake Erie	209 (516)	57 (141)	7,363 (18,195)		936 (2,313)	2,113 (5,221)	1,067 (2,637)	11,745 (29,023)
Lake Ontario	451 (1,114)	2,571 (6,353)	216 (534)		2,442 (6,035)	1,815 (4,484)	239 (590)	7,734 (19,110)
St. Lawrence River	2,796 (6,910)	1,605 (3,965)			776 (1,917)	539 (1,333)	9 (23)	5,726 (14,148)
Total	4,915 (12,149)	4,283 (10,729)	7,579 (18,729)	6,808 (16,824)	4,205 (10,391)	4,473 (11,053)	6,655 (16,446)	38,920 (96,174)

*From: McCullough, G.B. and F.G. Thornton. 1979. Inventory of Ontario's Lower Great Lakes Wetlands. Canadian Wildlife Service, London, Ontario.

**Area expressed in hectares; acres in parentheses.

Appendix 6

GREAT LAKES FILL OF NON-AQUATIC ORIGIN
REGULATIONS, GUIDELINES AND PRACTICES

For the purposes of this report, the term "fill" will be taken to mean soil, rocks, sand, waste of any kind or any other material which displaces soil or water or reduces water retention potential whose origin before aquatic or wetland disposal was non-aquatic or land-based (i.e. non-dredged material).

When fill is placed in the connecting channels of the Great Lakes there may be adverse effects on flows, levels and currents, with the effects on levels extending to the upstream lake. Article III of the 1909 Boundary Waters Treaty states that "...no further or other uses or obstructions or diversions, whether temporary or permanent of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission...."

CANADA

Federal Government

Although there are no specific regulations or guidelines governing the dumping of fill into the Great Lakes, there is legislation which can be used to regulate this activity. Also, approval is needed from fishery managers before fill is dumped into water.

Under the Federal Fisheries Act, Sec. 31 (1) Harmful alteration etc. of fish habitat ..."No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat." Section 33, Injury to Fishing Ground and Pollution of Waters:

"(2) Deposit of deleterious substance prohibited. Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where such deleterious substance that results from the deposit of such deleterious substance may enter any such water."

"(4) Deposits authorized by regulation. No person contravenes subsection (2) by depositing or permitting the deposit in any water or place:

(a) of waste or pollutant of a type, in a quantity and under conditions authorized by regulations applicable to that water or place made by the Governor in Council under any Act other than this Act; or

(b) of a deleterious substance of a class in a quantity or concentration and under conditions authorized by or pursuant to regulations applicable to that water or place or to any work or undertaking or class thereof, made by the Governor in Council under subsection (13)."

"(13) The Governor in Council may make regulations for the purpose of paragraph (4) (b) prescribing:

(a) the deleterious substances or classes thereof authorized to be deposited notwithstanding subsection (2)."

Section 33.1 (1) Minister may require plans and specifications. "Every person who carries on or proposes to carry on any work or undertaking that results or is likely to result in

(a) the deposit of a deleterious substance in water frequented by fish or in any place under any conditions where that deleterious substance or any other deleterious substance that results from the deposit of that deleterious substance may enter any such water, or

(b) the alteration, disruption or destruction of fish habitat,

shall, on the request of the Minister or without request in the manner and circumstances prescribed by regulations made under paragraph (3) (a), provide the Minister with such plans, specifications, studies, procedures, schedules, analyses, samples or other information relating to the work or undertaking and with such analyses, samples, evaluations, studies or other information relating to the water, place or fish habitat that is or is likely to be affected by the work or undertaking as will enable the Minister to determine

(c) whether there is or is likely to be a deposit of deleterious substance by reason of such work or undertaking that constitutes or would constitute an offence under section 33 and what measures, if any, would prevent such a deposit or mitigate the effects thereof; or

(d) whether the work or undertaking results or is likley to result in any alteration, disruption or destruction of fish habitat that constitutes or would constitute an offence under section 31 and what measures, if any, would prevent such a result or mitigate the effects thereof".

Section 34 Regulations. The Governor in Council may make regulations

(a) "for the proper management and control of the seacoast and inland fisheries;
(b) respecting the conservation and protection of fish;
(h) respecting the obstruction and pollution of any waters frequented by fish;
(i) respecting the conservation and protection of spawning grounds ...".

Under the Federal Migratory Birds Convention Act, Section 51:

"No person shall place, cause to be placed or in any manner permit the flow or entrance of oil, oil wastes or substances harmful to migratory birds into or upon waters or upon the ice covering such waters."

When processing fill applications under the Navigable Waters Protection Act (NWPA), the Canadian Coast Guard seeks review from the Provincial and Federal Departments of Environment when amounts of fill are significant or are suspected of being contaminated before granting approval.

Since the early 1970's a number of landfill developments have appeared in the coastal zone of Lake Ontario. The main purpose of these landfills is to extend recreational opportunities in areas previously inaccessible to the public. In a report on "Recreational Landfills and the Lake Ontario Environment" (Collins & Boulden), Environment Canada's Environmental Protection Service (EPS), Ontario Region, recommended that:

- proposed recreational landfills should not be located near sewage, storm sewers, filter backwash and/or industrial discharges, heated discharges and river mouths (when adverse impacts have been identified);

- total body contact water sports be banned where the Ontario Ministry of the Environment's (MOE) Criteria for Total Body Contact Recreation are exceeded;

- landfill projects that will be exposed to wave attack during the development stages should be advanced only during the late spring and summer months. During the winter the exposed face should either be armoured continuously from the shoreline or protected behind suitably armoured hard points. Hard points or armouring should be completed no later than the end of October;

- to control the quality of fill used, representative samples should be taken with respect to each source of fill and sampled for bacteria, organics and heavy metals. The sampling frequency could probably be reduced once the program was established and certain trends identified relative to particular sources of fill;

- to prevent the indiscriminate dumping of garbage at these landfills, all trucks should be visually inspected prior to dumping and the site should be gated and locked outside of normal working hours;

- adjacent shores and their susceptibility to erosion should be thoroughly assessed with respect to any recreational landfill disposal.

<u>Ontario</u>

The Conservation Authorities Act allows Conservation Authorities to regulate development in areas under its jurisdiction. The Act enables authorities to:

1. control the flow of surface waters in order to prevent floods or pollution or to reduce the adverse effects thereof;

2. make regulations prohibiting or regulating or requiring the permission of the Authority for the construction of any building or structure in or on a pond or swamp or in any area susceptible to flooding during a regional storm, and defining regional storms for the purposes of such regulations;

3. make regulations prohibiting or regulating or requiring the permission of the Authority for the placing or dumping of fill of any kind in any defined part of the area over which the Authority has jurisdiction in which, in the opinion of the Authority, the control of flooding or pollution or the conservation of land may be affected by the placing or dumping of fill.

4. order a convicted person to remove illegally dumped fill.

The Ontario Ministry of the Environment (MOE) recommends that material for use in recreational landfill should generally meet their Marine Construction Guidelines for the open water disposal of dredged materials (see earlier Appendix 3-A). Periodic visual inspection of loads, however, is generally the only form of quality control at a landfill dumping site.

Another piece of legislation that could be used is "The Endangered Species Act of 1971" which prohibits the destruction or interference with the habitat of any species of fauna or flora declared to be threatened with extinction. In addition, when filling activities are carried out by provincial ministries, agencies and municipalities, they are subject to the Ontario Environmental Assessment Act of 1975.

The Lakes and Rivers Improvement Act provides for the use of waters of the lakes and rivers of Ontario and to regulate improvements in them. For example, Sec. 36 (1) Prohibition against throwing refuse into lake or river, etc. "No person shall throw, deposit or discharge, or permit the throwing, depositing or discharging of, any refuse, sawdust, chemical, substance or matter from any mill into a lake or river, or on the shores or banks thereof." gives the Ministry of Natural Resources some control over filling. In addition, Sec. 36 (3) enables the Minister to order an offender to remove such refuse, sawdust, chemical, substance or matter from the water or shore. Guidelines for assessing the Ministry of Natural Resources' projects are presently being prepared as a document entitled Class Environmental Assessment for Ontario Ministry of Natural Resources Activities concerned with water related excavation and filling.

The Toronto Harbour Commission has been dumping fill into Lake Ontario since the turn of the century, but only extended their activity into the open waters of the lake in the 1950's. To put the scope of this activity into perspective, the Toronto Harbour Commission has filled 267.2 acres with 18.36 $\times 10^6$ yd^3 of fill material (exclusive of main harbour channel dredging) from 1956 to 1977. As of November 1978, 4,300,000 truck loads of material have been directed towards the development of 570 acres of port facilities and waterfront parks (The Toronto Harbour Commission, 1978).

The Metro Toronto and Region Conservation Authority (MTRCA) and two other conservation authorities on Lake Ontario have announced and/or embarked upon programs to create waterfront park land from fill material. Monitoring of water and sediment quality has been carried out at the MTRCA sites and to a lesser degree at the Toronto Harbour Commission site, with almost no data available at the other two sites.

UNITED STATES

Federal Government

There were major filling activities in the past for industrial expansion and housing construction. Many of these filling activities were into wetlands adjacent to developed property. There is presently little fill activity occurring on the United States Great Lakes shoreline. The areas of most intensive activities are along Lake St. Clair, the St. Clair River and the Detroit River. These activities consist primarily of fill material placed behind bulkheads for shore erosion protection. Since most current filling activities consist of the confined (i.e. behind bulkheads) placement of material taken from areas not suspected of being contaminated, testing has often not been required. Testing has, however, been required for material derived from suspect areas (industrial property) or when slag or similar materials are used.

Federal regulations pertaining to fill material in the Great Lakes Basin are in Section 10 of the River and Harbors Act of 1899 which requires permits for construction or fill in navigable waters and Section 404 of the Clean Water Act which applies to the discharge of fill material as well as dredge material into the waters of the United States. The Section 404 permit program is currently administered by the U.S. Army Corps of Engineers. Section 404 (g) and (h) provide that, upon approval by the Administrator of EPA, a State may administer its own individual and general permit program to control discharges of dredged or fill material (Thronson 1979). Thus, fill material is treated in a manner similar to dredge material (see earlier Appendix 3-B for Pollutional Classification Guidelines).

The Act further authorizes states with approved statewide regulatory programs under Section 208 (b) (4) to regulate some discharges of dredged or fill materials through those programs instead of the Section 404 permit program. Actions regulated by a statewide 208 (b) (4) program must be those which EPA has designated as applicable for this alternative method of regulation and for which specific Best Management Practices criteria have been developed by the State and approved by EPA. Where the use has been altered, the flow or circulation impaired, or the reach of the water body reduced, regulation under Section 208 is precluded. Under these conditions, Best Management Practices must be implemented under the 404 permit program (Section 404 (f) (2). "Best Management Practices Guidance, Discharge of Dredged or Fill Material" (Thronson 1979) were developed to provide agencies with the most readily available general information on how adverse environmental impacts resulting from discharges of dredged or fill materials can be prevented, or minimized (Thronson 1979). "Best Management Practices, Summary" is reproduced in Attachment 1.

In addition, if the fill material should be a hazardous waste as defined by the Resource Conservation and Recovery Act of 1976 (40 CFR Parts 260 and 261), the material must be handled in accordance with the regulations contained in 40 CFR Parts 260 and 265 and Parts 122 to 124 (May 19, 1980). These regulations would prevent the use of hazardous waste as a fill material by only allowing disposal of such material in a federally permitted hazardous waste disposal facility.

Illinois

The State of Illinois' Lake Michigan shoreline has had a history of significant fills, particularly along the Chicago lakefront. In recent years, however, fills have been very minor in nature. Fill must not involve the taking of public property and, in Illinois, title to the Lake Michigan bed remains with the State.

The Division of Water Resources of the Illinois Department of Transportation is responsible for issuing permits for work in and along Lake Michigan, pursuant to the Rivers, Lakes and Streams Act of 1911, as amended, Illinois Revised Statutes, Chapter 19, Section 65 (selected parts are reprinted in Attachment 2).

Presently, fills along the shoreland of Lake Michigan are for shore protection purposes and generally consist of non-polluting materials such as quarry stone and concrete. The fill materials used should not contain any materials such as dirt, debris, asphalt or any other materials which could be harmful if washed into the lake. Any significant fills into Lake Michigan require a chemical analysis to make sure that the material is clean and does not contain any significant pollutants. Determination as to whether material is polluted involves review by the Illinois Environmental Protection Agency which is generally consistent with the Federal EPA standards.

In summary, the only significant fills into Lake Michigan are those that result from maintenance dredging of clean sand. If a major fill is proposed that would involve the placement of materials of a non-aquatic origin into Lake Michigan, it would require legislative approval by the Illinois General Assembly and would also involve the preparation of a detailed environmental impact statement.

Indiana

The filling of the Indiana waters of Lake Michigan has been uncontrolled until recently. Practically at will shoreline property owners, particularly industries, have been permitted to fill in the lake to make room for further expansion. In 1906 a joint resolution of Congress required Federal permits from the Secretary and Chief of Engineers of the Department of War to approve the planned man-made lands prior to the filling of Lake Michigan by riparian owners. These riparian owners were given the right to fill in submerged land adjacent to and within the width of their shoreline property in 1907. The man-made fills could not extend lakeward of the dock and harbor line as established by the U.S. Army Corps of Engineers (Indiana Department of Natural Resources, 1979).

Realizing that the original Lake Michigan shoreline was vanishing, the Indiana Department of Conservation Commission resolved in 1961 that, "in principle it did not favor further encroachment by filling in upon the waters and shores of the portions of Lake Michigan situated within the boundaries of the State." Recognizing that the shoreline of Lake Michigan was indeed a natural resource to be conserved and protected, the Indiana legislature amended I.C. 4-18-13 to read, "the natural resources commission with the approval of the governor of the state may issue to such owner or owners authority to fill in and improve such land." This 1973 amendment to the man-made land authorization act significantly changed the state's permit issuance responsibility from the previous mandatory shall to a discretionary may (Indiana Department of Natural Resources, 1979). The Department of Natural Resources would have specific objections to fills of any kind in Indiana waters, unless it could be affirmatively demonstrated that this was the only viable alternative.

Indiana law then prohibits the disposal of polluted materials into Lake Michigan. The only standards by which the polluted nature of fill is judged are those contained in the "Water Quality Standards; Specific Waters of the State" as adopted by the Indiana Stream Pollution Control Board. The more relevant portions of the standards are as follows: (more detailed and quantified information can be found in the Regulation)

"Section 2 - Nondegradation Policies

(a) Harbor areas - For all waters of the contiguous harbor areas, designated beneficial uses shall be maintained and protected."

"(c) National or State Resource Waters - All waters of high quality which are designated by the Board to be outstanding National or State resources shall be maintained in their present high quality without degradation. Similarly, all waters incorporated by the Indiana Department of Natural Resources into the Natural, Scenic and Recreational River Systems shall be maintained in their present quality as well as those portions of Lake Michigan incorporated in the Dunes National Lakeshore."

"Section 4 - Water Quality Standards

(a) Minimum Water Quality Conditions - All waters of Lake Michigan and the contiguous areas at all times and all places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil or scum attributable to municipal, industrial, agricultural and other land use practices, or other discharges...."

"(b) Minimum Water Quality Standards...to insure conditions necessary for the maintenance of whole body contact recreation and a well-balanced fish community. These standards are also sufficient to provide the protection and propagation of shellfish and wildlife...."

A complete record of man-made fills in Lake Michigan is now available from the State Department of Natural Resources' files or up to 1979 in its "Technical Report No. 304". There are now 10 permit holders along the Indiana shoreline. Since the 1907 legislation approximately 6,515 acres of man-made lands have been authorized, of which about 2,827 acres remain to be filled and/or patented. Also, the Indiana Port Commission and the city of Whiting filled 86 and one acres, respectively, without the need of a State permit (Indiana Department of Natural Resources, 1979). While little information exists concerning the source or nature of these fill materials, most are thought to consist of slag materials produced by nearby steel mills.

Michigan

The Shorelands Protection and Management Act (Act 245, Public Acts of 1970 as amended by Act 270, Public Acts of 1974) regulates the placing of fill or other earth changes within the boundaries of a designated environmental area which are usually wetland areas with some limited uplands. It reads in part:

> "(6) The following shoreland uses in an environmental area shall require a permit from the department in accordance with these rules or from a local governmental agency pursuant to an ordinance approved by the department.
>
> (a) Dredging, filling, grading or other alterations of the soil....
>
> (7) Farming of lands within the environmental area is allowed without a permit if artificial draining, pumping, diking, dredging or filling are not used...." (Michigan Department of Natural Resources, 1979, p. 33).

The Great Lakes Submerged Lands Act (Act 247, Public Acts of 1955, as amended) was initially adopted by the State to halt filling of State-owned Great Lakes bottomlands lying below the ordinary high water mark. Pertinent parts of the Act read:

> "Section 3 (a) After the effective date of this amendatory act of 1965, a riparian owner shall obtain a permit from the department, for which no charge shall be made, before dredging or placing spoil or other materials on bottomland.
>
> Section 5 (a) The department may permit, by lease or agreement, the filling in of patented and unpatented submerged lands and permit improvements and structures after finding that the public trust will not be impaired or substantially injured." (Michigan Department of Natural Resources, 1955).

Although the Solid Waste Management Act (Act 641, Public Acts of 1973) does not regulate the actual filling of wetland areas; it does specify what types of material may be used for fill. Uncontained fills must be of a clean, inert nature. The type of containment for contaminated fills is dependent upon the nature or classification of the contaminants (State of Michigan 79th Legislature, 1978).

The Wetland Protection Act which is to take effect October 1, 1980 (State of Michigan 80th Legislature, 1979) will regulate filling, dredging, construction or draining of all wetland areas contiguous to the Great Lakes through a permit process. Portions of the Act read:

"An act to provide for the preservation, management, protection and use of wetlands; to require permits to alter certain wetlands; to provide for a plan for the preservation, management, protection and use of wetlands; and to provide remedies and penalties.

Section 1 (c) Fill material means soil, rocks, sand, waste of any kind or any other material which displaces soil or water or reduces water retention potential.

Section 5 - Except as otherwise provided by this act or by a permit obtained from the department under Sections 7 to 12, a person shall not:

(a) Deposit or permit the placing of fill material in a wetland.
(b) Dredge, remove or permit the removal of soil or minerals from a wetland.
(c) Construct, operate or maintain any use or development in a wetland.
(d) Drain surface water from a wetland."

Minnesota

The Commissioner of Natural Resources is authorized to promulgate rules and enter into agreements with landowners for the conservation of wetlands. Also, State law requires a permit from the DNR before any change or obstruction on any public water, or before any change or diminution of the course, current or cross-section of any public waters is made by any means, including but not limited to filling, excavating or placing of any materials in or on the beds of public waters (Minnesota Stat. 105.42 Office of Coastal Zone Management, 1978).

The Shoreland Management Act, Minnesota Stat. 105.485 states that it is in the public interest to provide guidance for the wise development of shorelands of public waters and thus preserve and enhance the quality of surface waters, preserve the economic and natural environmental values of shorelands and provide the wise utilization of water and related land resources. All counties and municipalities are required to adopt shoreline management ordinances, which meet statewide standards, established by the DNR and governing the placement of structures, lot sizes, land uses, etc. (Under Minnesota Statutes 112.34 - 112.86, Office of Coastal Zone Management, 1978) (Attachment 3).

The Minnesota Water Resources Board can establish watershed districts for conservation purposes such as reclaiming or filling wet and overflowed land and regulating improvements by riparian owners of beds, banks and shores of lakes, streams and marshes by permit or otherwise in order to preserve the same for beneficial use (Office of Coastal Zone Management, 1978).

The Minnesota Environmental Policy Act (Minnesota Stat. 116D-01 - 116D-107) states that all practical means should be used to reduce the deleterious impact on water quality from all sources (Office of Coastal Zone Management, 1978).

Waste materials which are explosive, flammable, irritative, corrosive, oxidative or toxic by the criteria established in the Minnesota Hazardous Waste Rules (6 MCAR § 4.9001 - 4.9010) are hazardous wastes, and must be disposed of in facilities permitted to receive hazardous wastes. In addition, the Hazardous Waste Rules provide that if a waste contains more than specified concentrations of certain carcinogenic compounds (List 1 in 6 MCAR § 4.9002) or if leachate from the waste contains more than specified concentrations of certain bioaccumulative compounds (List 2 in 6 MCAR § 4.9002), it is a hazardous waste and must be managed as such.

Non-hazardous solid wastes are regulated by the Minnesota Pollution Control Agency (MPCA) under State Statutes Chapter 115 and State Rules, SW 1 through 12 and must be disposed of in a manner approved by the MPCA. Putrescible materials must be disposed of in a sanitary landfill. Disposal of all demolition debris and fly ash must be at sites approved by permit or letter of approval in accordance with plans and specifications which have been reviewed and approved specifically for a project. Disposal demolition or construction projects (earth, rocks, stones, trees, bituminous surfacing, concrete, bricks, lumber, plaster, metals, glass and plastic building parts) in permitted sanitary landfills is not recommended. However, the MPCA does regulate these materials, and approved sites for disposal must be used for such materials. Sewage sludge may be disposed of by land application, but only in accordance with MPCA guidelines for disposal of sewage sludge.

The discharge of excavated or dredged materials is regulated by MPCA permits issued under State Statutes Chapter 115 and/or when federal permits are required, Section 401 Certification authority under the Clean Water Act of 1977. Each project must be evaluated on an individual and site specific basis. Generally, upland or confined disposal of dredged or excavated material would be considered approvable. Open water disposal of any material is not normally permitted but may be considered in exceptional cases where there may be a beneficial purpose. Where dredged materials have a potential of being contaminated, sampling of the materials may be required prior to its use. Specific analyses must be determined and evaluated on a site specific basis before disposal decisions can be made.

New York

Under the Protection of Waters Program, the New York Department of Environmental Conservation (DEC) requires permits for: changes, modifications, or disturbances to beds or banks of protected streams; excavations or fills in naviagable waters; the construction, reconstruction or major repair of sizeable dams and docks; and the removal, replacement or repair of illegal or unsafe structures, fills or excavations. Recently, DEC and the Buffalo District Corps of Engineers developed a joint application for the discharge of fill material into navigable bodies of water. The DEC strategy is to extend the joint application agreement to include the remaining five Corps Districts having jurisidiction in New York State (NYS/U.S. EPA 1979).

The Freshwater Wetlands Act provides for the regulation of all Freshwater Wetlands in the State over 12.4 acres (5 hectares) in size, as well as smaller wetlands deemed by DEC to be of unusual local importance. Activities on adjacent areas within 100 feet of the regulative boundary of the wetland are also regulated. An interim permit program went into effect in September 1975 and states that no one may conduct a regulated activity (such as dredging, filling or polluting) in a wetland without obtaining an interim permit. DEC determines whether or not a particular area is a wetland subject to regulation. Permits are granted only if the applicant can demonstrate that a hardship would be suffered without the permit (NYS/U.S. EPA 1979).

A permanent regulatory program goes into effect as a wetlands inventory is completed and regulatory maps are approved. Each local government may adopt a wetlands protection law at least as restrictive as the state law and regulate wetlands within its boundaries, with DEC providing technical assistance and performing monitoring activities to ensure compliance with the state law. One of the program strategies is to eliminate through the permit process, to a practical degree, the human-induced loss of wetlands (NYS/U.S. EPA 1979).

Ohio

The State allows only clean material to be used as fill in its waters as under Section 401 Water Quality Certification review. Also, the Ohio Department of Natural Resources administers the Stream Litter Law, ORC 1531.13.1 which controls dumping of trash into State waters and can be used to control some fill activities along Lake Erie.

Fill activity of non-aquatic origin through Corps of Engineers' permit for Ohio's Lake Erie shoreline are as follows for 1979:

Upland borrow (earthen)	52,827 yd^3/41.3%
Rip-rap	39,805 yd^3/31.2%
Granular (stone, sand, gravel)	30,929 yd^3/24.2%
Broken concrete	4,225 yd^3/ 3.3%
Total	127,786 yd^3

Pennsylvania

The Department of Environmental Resources rules and regulations relating to the protection of natural resources would apply to control the placement of non-aquatic fill in Lake Erie and its tributaries. Relevant parts of these sets of criteria are Chapter 93, Water Quality Standards which states:

"93.6 - General Water Quality Criteria

(a) Water shall not contain substances attributable to point or nonpoint source waste discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life.

(b) Specific substances to be controlled shall include, but shall not be limited to, floating debris, oil, grease, scum and other floating materials, toxic substances, pesticides, chlorinated hydrocarbons, carcinogenic, mutagenic and teratogenic materials and substances which produce color, tastes, odors, turbidity or settle to form deposits." (Pennsylvania Department of Environmental Resources, 1979, p. 3053).

More detailed information on specific water quality criteria is also available from the above referenced legislation.

Also, Chapter 105, Water Obstructions and Encroachments, Subchapter F - Fills, Levees, Floodwalls and Streambank Retaining Devices pertains directly to filling and is reproduced in Attachment 4. An attempt is presently being made to revise Subchapter F which would provide for protection of wetlands and would provide further control over filling under Pennsylvania's Coastal Zone Management Program.

Filling in Pennsylvania's portion of Lake Erie has recently been almost non-existent. The only project worthy of mention has been the development of a new basin at the mouth of Presque Isle Harbor, sponsored by the U.S. Army Corps of Engineers. There is presently no information available to the State on the quantity and quality, or the general location of the source and disposal of fill.

Wisconsin

Disposal of fill is regulated in Wisconsin in the same manner in which dredged material disposal is regulated. The same Statutes apply and these do not discriminate on the basis of material origin. It is the act of placement and disposal that is regulated. Water Regulatory Permits under Chapter 30, Section 30.12 of the Wisconsin Statutes prohibits fills and deposits on the bed of any navigable water. There is no permit provision for material deposits on the bed of any navigable body of water. Permits, however, are issued under 30.12 for placing structures, sand blankets, fish cribs, or rip-rap in navigable waters (Wisconsin Coastal Management Program, 1979).

CONCLUSIONS

Most jurisdictions and agencies do not have specific regulations or guidelines governing the dumping of non-aquatic fill into the Great Lakes and their tributaries. In most cases, however, legislation does exist which could be used or interpreted to regulate such dumping. In general, the same laws that regulate disposal of dredged material regulate disposal of fill of non-aquatic origin.

There is a paucity of information on the quality and quantity of fill and the location of its source and disposal sites. Some of the fill quality problems are the result of indiscriminate garbage dumping which is compounded by the usual ease of site access. It is believed that fill losses to the lake affect water quality in a manner similar to that of the open water disposal of dredged material when quality of material is taken into account. Whereas the open water disposal of dredged material has recently received much attention and such activity is now carefully scrutinized, filling operations generally receive much less attention.

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ATTACHMENT 1

BEST MANAGEMENT PRACTICES, SUMMARY*

Best Management Practices for preventing environmental impacts from the discharge of dredged or fill materials into waters of the United States are, to a large extent, technically feasible and available. After all alternatives to a project have been evaluated, based upon 404 (b) (1) guidelines, and the decision has been made that the discharge or placement of dredged or fill material is to be conducted, effective procedures, measures and practices for preventing environmental problems can be devised and implemented. They involve practical engineering designs, structures, procedures, and schedules for operations adapted from those that have been developed and used for many years to control surface or subsurface flows of water, prevent the loss of materials from a site area, and provide for the protection and propagation of fish, shellfish and wildlife. The specific characteristics of the site must be evaluated and considered critically before finalizing BMP's to be applied or used.

Since many of the environmental concerns we have now were not of vital interest during the conduct of past engineering projects, many of the existing techniques and structures are inadequate for environmental protection or create, rather than prevent, such problems. In view of this, modification of the design of many structures and the procedures for their placement or construction are essential to reverse this trend and protect the environment rather than damage it.

Environmental problems that could result from the discharge of dredged or fill materials into streams, estuaries, lakes or wetlands can be prevented or minimized through implementation of effective Best Management Practices. Descriptions, discussions and examples of BMP's are presented in the following five chapters of this guidance document. They include, but are not limited to operating procedures, scheduling of activities or management practices which can be conducted or applied to ensure that: 1) stream or current flow changes are not adversely affected; 2) increased sediment loads or turbidity levels are effectively reduced and 3) other pollutants included with dredged or fill materials are restricted from entering water bodies. BMP's may also involve: 4) protecting existing habitat and providing for fish and wildlife propagation and 5) the relocation, reconstruction or enhancement of an area of wetlands or a stream if a significant portion of the water body will be affected and no other alternative exists.

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*From Thronson, R. E. Best Management Practices Guidance, Discharge of Dredged or Fill Materials, U.S. Environmental Protection Agency, Washington, D.C., September 1979.

Best Management Practices involving singular minor discharges of dredged or fill materials with relatively insignificant impacts on the aquatic environment are similar to those needed for major discharges with significant impacts. They are much less elaborate and expensive, however, and generally require no formal design or rigid application specifications. It must be emphasized here that the results desired with regard to the protection of the chemical, biological and physical integrity of our Nation's waters are the same with either large or small discharges.

Preventing Impairment of Water Flow or Ciculation

Masses of dredged or fill materials placed (or discharged) into streams, lakes or wetlands can impair the natural movement or circulation of water. The degree of impairment will depend upon the volume, permeability and location of the material that is discharged where it can reduce the cross sectional area through which the water flows. This applies to the subsurface flow of water as well as to surface movement. A permit for discharge may be required in accordance with Section 404 if flow or circulation will be impaired and the BMP's implemented as a requirement of this program.

There are several ways to reduce or prevent the impairment of circulation or flow. They involve one or more of the following basic techniques regarding discharge or placement of dredged or fill materials:

1. Minimizing the extent of individual fills or the concentration or number of fills.

2. Providing continuous open channels through, or around, masses of materials parallel to natural flow directions.

3. Using alternate sections of impervious fill with pervious sections or open structures to permit free flow of water.

4. Designing channel - spanning structures:

   a. To pass flood flows with no significant adverse impacts from flow restriction.
   b. To minimize debris or other blockage which can obstruct flow.
   c. In accordance with upstream and downstream hydraulic flow conditions (do not cause drastic changes in flow regime).

5. Aligning bridges, culverts and other structures to limit adverse impacts from flow disruption resulting from abutments or other fills.

Preventing or Controlling the Runoff of Excess Sediment Loads or Turbidity Increases

Excess sediment loads or turbidity increases can occur as a result of the placement of dredged or fill materials into water bodies and wetlands. The erosion and transportation of particulates can take place during the actual placement of the dredged and fill materials if no preventive measures such as cofferdams, caissons, filter cloth fences or other preventive devices or procedures are used. To prevent in-place or completed dredged or fill deposits from being subjected to the erosive forces of high velocity surface flows, effective surface protection measures such as rip rap blankets (or layers), concrete walls and similar measures should be provided. The erosion and transport of sediments can be minimized or prevented by one or more of the following measures or practices:

1. Placing materials on dry land by scheduling operations during low flows, using structures to exclude the water or by temporarily diverting the stream from the site.

2. Protecting slopes that will be subject to erosion by surface flows with erosion resisting coverings such as vegetation, rip rap blankets (with or without underlying filters), gabions, retaining walls, aprons, wing walls and similar measures.

3. Designing bridge-supporting members such as piers, piles, etc., to minimize scour.

4. Providing filter cloth or some other type of filtering media to remove sediment being transported from an area of placement.

5. Avoiding placement of dredged or fill material during conditions that may be critical for sensitive aquatic life and wildlife such as spawning seasons or migration times.

6. Using placement procedures to prevent or restrict the movement of mobile equipment in the water. Equipment used should be that having the least damaging effect on ground conditions.

Extreme care should be taken during the planning, design and placement of a fill to ensure that structural failure does not occur during the project life to allow the material to enter a water body or adjacent wetland. Adequate criteria should establish the factors of safety to be used in the design and placement. Adequate and continuing processes will be necessary to assure that conditions are maintained.

<u>Ensuring Containment of Potential Pollutants within the Discharged Mass of Dredged or Fill Materials</u>

At times dredged or fill materials placed or discharged into streams, lakes, wetlands or other water bodies may contain natural materials such as iron sulfide (pyrite), calcium sulfate (gypsum) and various salts. These materials are not pollutants in their source areas but can become pollutants when transported into and deposited in another environment. If polluted materials can be effectively contained by effective BMP's and prevented from affecting water quality, their discharge should not be precluded only because of their quality. Effective containment within the mass of materials is essential for use. It can be done by:

1. Surrounding the poor quality material during placement with walls and blankets of relatively impervious materials such as compacted fill, concrete or similar materials. Drain blankets for pumpout of fluid may be desirable.

2. Restricting the use of poor quality materials to areas above high water elevations and capping them with relatively impervious blankets of fill to prevent infiltration of rainfall and subsequent leaching.

3. Blending poor quality materials such as pyrite with naturally occurring neutralizing materials such as crushed limestone during placement.

Protecting Habitat and Providing for Fish and Wildlife Propagation

The disposal of dredged or fill materials into water bodies or wetlands can cause detrimental changes to occur in the habitat for fish and wildlife, particularly in the immediate locality of the discharge. Migration routes or access to select food sources can be blocked or restricted, fish spawning areas destroyed or propagation activities interfered with and key ecological relationships and interdependencies disturbed.

Best Management Practices for mitigating or preventing these environmental problems can involve scheduling of operations to avoid creating problems during conditions that are critical for aquatic and other wildlife. This could include spawning, migration, nesting and other periods where the effects of discharge activities could be much more critical than during other times. Other practices may involve the proper management of activities as well as the modification or construction of structures and techniques to offset terrain changes, water level and flow alterations and revision in the natural physical or biologic integrity of the water bodies and wetlands due to the discharge. They could include:

1. Creating avenues for movement of aquatic life and wildlife through structures formed of dredged or fill materials.

2. Providing protective devices for wildlife encountering or crossing structures formed of dredged or fill materials.

3. Creating necessary habitat improvement measures.

Enhancement, Replacement, Relocation or Reconstruction of Existing Environment

If, after evaluating all alternatives, the placement of dredged or fill materials into wetlands or other water bodies is justified and other available Best Management Practices will not effectively prevent adverse effects, enhancement or replacement of the existing environment may be feasible. This must receive consideration if a significant percentage of the water body becomes dry land due to the discharge and/or placement of materials. Practices may include:

1. Creating and maintaining additional wetlands equivalent in productivity to those destroyed by the discharged deposits.

2. Providing shallow or deep water areas equivalent to those destroyed by the placement of materials for the maintenance of aquatic life and other wildlife.

3. Providing for the relocation or replacement of streams that have been designed and constructed to function under original gradient, hydraulic and aquatic habitat conditions.

2. [illegible]

5. Blending poor quality materials such as pyrite with naturally occurring neutralizing materials such as crushed limestone during placement.

Protecting Habitat and Providing for Fish and Wildlife Propagation

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Best Management Practices for mitigating or preventing these environmental problems can involve proper timing of operations to avoid creating problems during operations that are critical for aquatic and other wildlife. This could include avoiding discharges during or near nesting periods where the effects of disposal operations would be more detrimental than during other times. These practices may lead to the proper management of activities as well as the modification or construction of structures and techniques to offset terrain changes, water level and flow alterations and revisions in the natural physical or biological properties of the water bodies and wetlands due to the discharge. These might include:

1. Creating avenues for movement of aquatic life and wildlife through structures formed of dredged or fill materials.

2. Providing protective devices for wildlife encountering or crossing structures formed of dredged or fill materials.

3. Creating necessary habitat improvement measures.

Enhancement, Replacement, Relocation or Reconstruction of Existing Environment

If, after evaluating all alternatives, the placement of dredged or fill materials into wetlands or other water bodies is justified and other available Best Management Practices will not effectively prevent adverse effects, enhancement or replacement of the existing environment may be feasible. This must receive consideration if a significant percentage of the water body becomes dry land due to the discharge and/or placement of materials. Practices may include:

1. Creating and maintaining additional wetlands equivalent in productivity to those destroyed by the discharged deposits.

2. Providing shallow or deep water areas equivalent to those destroyed by the placement of materials for the maintenance of aquatic life and other wildlife.

ATTACHMENT 2

ILLINOIS REVISED STATUTES

CHAPTER 19 - CANALS AND WATERWAYS

Section 65 - Approval of structures in water -- Permit - § 18

It is unlawful to make any fill or deposit of rock, earth, sand, or other material, or any refuse matter of any kind or description or build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, causeway, harbor, or mooring facilities for watercraft, or build or commence the building of any other structure, or do any work of any kind whatsoever in any of the public bodies of water within the State of Illinois, without first submitting the plans, profiles, and specifications therefor, and such other data and information as may be required, to the Department of Transportation of the State and receiving a permit therefor signed by the Secretary of the Department and authenticated by the seal thereof. However, this requirement does not apply to duck blinds which comply with regulations of the Department of Conservation.

However, except as provided in this Act, no permit shall be issued or renewed authorizing any fill or deposit of rock, earth, sand, or other material, or any refuse matter of any kind or description in Lake Michigan except with the concurrence of the Pollution Control Board, and no such permit is valid without such concurrence.

Nothing herein shall be construed to authorize the discharge or other disposition of materials of any kind into Lake Michigan without first obtaining a permit signed by the Secretary of the Department of Transportation and countersigned by the Chairman of the Pollution Control Board acting on behalf of such Board, and any person, corporation, company, city or municipality, or other agency, who or which (1) discharges or disposes of any such materials into Lake Michigan with a permit or in violation of a permit, or (2) does any of the things prohibited by this Section shall be guilty of a Class A misdemeanor.

The building of any causeway, harbor, or mooring facilities for watercraft in Lake Michigan shall be confined to those areas recommended by the Department and authorized by the General Assembly and approved by the Governor and shall be in aid of and not an interference with the public interest or navigation. Any structure, fill, or deposit erected or made in any of the public bodies of water of this State, in violation of this Section, is a purpresture and may be abated as such at the expense of the person, corporation, company, city, municipality, or other agency responsible therefor, or if, in the discretion of the Department of Transportation, it be decided that the structure, fill, or deposit may remain, the Department may fix such rule, regulation, requirement, restrictions, or rentals or require and compel such changes, modifications and repairs as are necessary to protect the interest of the State.

The Department of Transportation may grant, subject to the foregoing provisions of this Section, a permit to any person, firm or corporation, not a riparian owner, to use the water from any of the public bodies of water within the State of Illinois for industrial manufacturing or public utility purposes, and to construct the necessary intakes, structures, tunnels, and conduits in, under, or on the beds of such bodies of water to obtain the use of such water or to return the same, provided, however, that such use shall not interfere with navigation. Such permit shall be for a definite period of years and exceeding 40 years and may be renewed subject to the same time limitation. If the water so to be used is to be taken from a lake or stream located in or adjoining any municipality, such permit shall not become effective until approved by the Commissioner of Public Works of such municipality, or if it has no Commissioner of Public Works, by the Public (or City) Engineer, or if it has no such Engineer, by the Mayor or President of the Municipality.

Subject to the notice and hearing hereinafter provided for, where a permit is sought for a structure, fill, or deposit in a slip, the Department shall require as condition precedent to the issuance of such permit, a signed statement approving such action by all riparian owners whose access to public waters will be directly affected by such structure, fill, or deposit. No such permit shall be issued without the approval of the Governor and without a public hearing, 10 days' notice of the time, place, and purpose of which is published in a newspaper of general circulation in the county in which such slip is located. Whenever a permit to fill or deposit in a slip is issued, all work done pursuant to the permit is by authorization and under the direction of the Department of Transportation. If deemed in the public interest, the Department of Transportation may, for the purpose of establishing uniform shore lines upon Lake Michigan or other streams or lakes of this State, permit fills of rock, earth or sand to be placed inside a bulkhead, wall or breakwater so constructed as not to permit the escape of such materials into Lake Michigan or any such lake, river, or stream, and the Department is authorized to require of applicants for such permits such contracts or to impose such restrictions as shall fully protect the interests of the State. However, the Department may permit the placing of unconfined fills or deposits of clear sand rock or other material approved by the Department in or along the shores of Lake Michigan or in, or along the shores of, other streams or lakes of this State for the purpose of replacing or augmenting the natural material in the littoral currents, for creating new beaches or for replenishing existing beaches, for the protection of the shore against erosion or for other lawful purposes specifically authorized by statute; and the Department may permit the deposit of dredged material in Lake Michigan only where the Department determines that the deposit or deposits of dredged material will not cause water pollution as defined in Environmental Protection Act. The restriction as to the deposit of dredged materials shall not apply to any reclamation of fill-in of Lake Michigan under the authority of any statute now or hereafter in effect or under the supervision of any park district or municipality where such materials are placed inside a bulkhead, wall or breakwater so constructed as not to permit the escape of such materials into Lake Michigan.

Wherever the terms public waters, public bodies of water, or streams and lakes are used or referred to in this Act, they mean all open public streams and lakes capable of being navigated by water craft, in whole or in part, for commercial uses and purposes, and all lakes, rivers, and streams which in their natural condition were capable of being improved and made navigable, or that are connected with or discharged their waters into navigable lakes or rivers, within, or upon the borders of the State of Illinois, together with all bayous, sloughs, backwater, and submerged lands that are open to the main channel or body of water and directly accessible thereto. Nothing herein contained applies to a harbor under the jurisdiction and control of a park district, nor to any existing yacht club facilities, improvements thereon and replacements thereof whether in the same or a new location. Nothing herein contained applies to the location of any harbor under the jurisdiction and control of any city or village of less than 500,000 population. Amended by P.A. 77-2329, § 1, eff. Jan. 1, 1973; P.A. 78-255, § 61, eff. Oct. 1, 1973.

65c - Agreements for building of harbor or mooring facilities - § 18c

The Department of Transportation, may also, upon the issuance of a permit under the provisions of Section 18 of this Act,[1] enter into an agreement with any person, firm or corporation to whom such permit is issued, by the terms of which agreement such person, firm, or corporation, may build or place in, upon or below the bed of that portion of Chicago Harbor in Lake Michigan lying South of the Chicago River Entrance, West of the U.S. Inner Breakwater, North of East 11th Place extended and East of the Harbor Line established by the Secretary of War in Lake Michigan, May 3, 1940, any causeway, harbor or mooring facilities for watercraft, and agrees to pay a rental, charges or fee to the State of Illinois for the use and occupation of any State owned lands which may be authorized to be utilized for such purposes; the rental, charge or fee shall be determined by said Department. No such agreement permitting any causeway, harbor or mooring facilities for watercraft in, upon or below the bed of said portion of Chicago Harbor in Lake Michigan shall be made, which by its terms, permits the use and occupation of State owned lands for a period of over 20 years, nor shall such agreement be entered into unless provision therein is made that such agreement shall be revocable at the will of said Department to permit use thereof by the State of Illinois for any public purpose. Amended by P.A. 77-161, § 1, eff. Jan. 1, 1972.

65f - Flood plains -- Defining -- Reports -- Planning, development and evaluation -- Construction permits - § 18f

The Department of Transportation shall define flood plains within the State of Illinois on a township by township basis and may issue permits for any construction within such flood plains on or after the effective date of this amendatory Act of 1971. The Department shall publish and distribute suitable reports, together with mapping and hydrologic exhibits pertaining to flood plains defined and established under this Act. In defining applicable flood plains, the Department shall cooperate with, and shall consider planning and zoning requirements of, regional planning agencies created by statute, counties, municipalities and other units of government. A period of thirty days shall be allowed for any agency to submit written comments to the Department regarding any proposed flood plain area. If such agency fails to

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[1]Chapter 19 § 65

return comments to the Department within the specified time period the Department may proceed with the publication and institution of the flood plain permit procedure. The Department is charged with the planning, development and evaluation of the most economic combination of retention storage, channel improvement and flood plain preservation in defining and establishing flood plain areas. All construction undertaken on a defined flood plain subsequent to the effective date of this amendatory Act, without benefit of a permit from the Department of Transportation, shall be unlawful and the Department, may in its discretion, proceed to obtain injunctive relief for abatement or removal of such unlawful construction. The department, in its discretion, may make such investigations and conduct such hearings as may be necessary to the performance of its duties under this amendatory Act of 1971. Activity of the Department under this Section shall be limited to townships related to projects of the Department authorized by the General Assembly. The report of the Department shall be considered a final administrative decision and subject to judicial review in accordance with the provision of the "Administrative Review Act", approved May 8, 1945.[1] Amended by P.A. 79-694, § 1, eff. Sept. 3, 1975.

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[1]Chapter 110, § 264 et seq.

ATTACHMENT 3

MINNESOTA SHORELAND MANAGEMENT ACT
FOR
COUNTIES AND MUNICIPALITIES
CHAPTER SIX: CONS. 70-84
STATEWIDE STANDARDS AND CRITERIA FOR MANAGEMENT OF
SHORELAND AREAS OF MINNESOTA

CONS. 73 (C) SHORELAND ALTERATIONS

(2) Grading and filling in shoreland areas or any alterations of the natural topography where the slope of the land is toward a public water shall be controlled by the county shoreland ordinance to prevent erosion and siltation of public waters and impairment of fish and aquatic life.

CONS. 77.4.3 SHORELAND ALTERATIONS

4.32 Grading and filling in shoreland areas or any alterations of the natural topography where the slope of the land is toward a public water or a watercourse leading to a public water must be authorized by a conditional use permit obtained from the Board of Adjustment. The permit must be granted subject to the conditions that:

(a) the smallest amount of bare ground is exposed for as short a time as feasible;

(b) temporary ground cover such as mulch is used and permanent ground cover such as sod is planted;

(c) methods to prevent erosion and trap sediment are employed and

(d) fill is stabilized to accepted engineering standards.

ATTACHMENT 4

TITLE 25. PENNSYLVANIA RULES AND REGULATIONS
PART 1. DEPARTMENT OF ENVIRONMENTAL RESOURCES
SUBPART C. PROTECTION OF NATURAL RESOURCES
ARTICLE II. WATER RESOURCES

CHAPTER 105. WATER OBSTRUCTIONS AND ENCROACHMENTS

SUBCHAPTER F. FILLS, LEVEES, FLOODWALLS AND STREAMBANK RETAINING DEVICES

GENERAL PROVISIONS

§ 105.231. SCOPE

(a) Except as provided in § 105.3 of this title (relating to scope), the provisions of this subchapter shall apply to the construction, alteration, enlargement, repair or removal of fills, levees, floodwalls and streambank retaining walls located in or along the regulated waters of the Commonwealth.

(b) Except as provided in § 105.3 of this title (relating to scope), the provisions of this subchapter shall also apply to the construction, alteration, enlargement, repair or removal of fills, levees or floodwalls located within the 100-year floodway of a regulated water of the Commonwealth which will substantially affect the elevation or velocity of floodwaters.

(c) For purposes of this subchapter, it shall be assumed that, absent justification to the contrary by the applicant, the following will substantially affect the elevation and velocity of floodwaters:

(1) Any fill, levee or floodwall within the floodway of a regulated water of the Commonwealth.

(2) Any fill, levee or floodwall within 50 feet of the top of the bank of a stream.

PERMITS

§ 105.241. PERMIT APPLICATIONS

In addition to the information required by §§ 105.11 and 105.12 of this title (relating to general permit applications and engineer's certification), all applications for permits pursuant to this subchapter shall contain the following information:

1. A plan detailing the location of all structures and properties within 1,000 feet upstream and downstream within the reach anticipated below the backwater level caused by the proposed fill, levee or similar structure and within the flood plain of the flood of record on both sides of the stream or body of water.

2. Basement and first floor elevations of structures indicated on the plan required by paragraph (1) of this subsection.

3. A complete hydraulic and hydrologic report on the proposed project, including, if the Department so requires, a backwater analysis of the project.

4. Complete cross-sections of the stream and floodway of the flood of record.

5. Stream profiles, showing the bed slope and the normal and flood water elevations for points 1,000 feet upstream and sufficiently far downstream as there may be an effect on the project, but not less than 1,000 feet downstream.

6. The type of all materials to be used on the fill, levee or similar structure.

7. Plans for the protection of the fill, levee or similar structure from erosion, both during and after construction.

8. The design flood for the fill, levee or similar structure.

9. A copy of the local flood plain management regulations or ordinances.

10. Plans for interior drainage.

DESIGN CRITERIA

§ 105.251. GENERAL CRITERIA

An application for any proposed levee, fill or similar structure in or along a stream or body of water will not be approved by the Department where:

1. it will increase flood heights, either on the opposite bank or upstream and flood easements or flood protection has not been provided;

2. it will create erosive velocities in the stream and appropriate protection has not been provided;

3. it will increase flood damages downstream through a loss of flood plain storage or

4. it is designed for a discharge less than the 100-year flood.

§ 105.252. WASTE MATERIALS

No waste materials of any type shall be used in the construction of fills, levees or similar structures, except in accordance with the provisions of the Solid Waste Management Act and Chapter 75 of this title (relating to solid waste management).

§ 105.253. SLOPES

The slope of any fill, levee or similar structure shall not be steeper than two horizontal to one vertical, unless special circumstances are demonstrated and adequate steps are taken to assure permanent stabilization of the slope.

§ 105.254. TOP WIDTH OF LEVEES

The top width of any levee shall not be less than ten feet.

§ 105.255. INTERIOR DRAINAGE

Adequate facilities shall be provided to drain the interior area behind the levee or floodwall.

§ 105.256. FREEBOARD ALLOWANCE

The height of a levee or floodwall shall provide an allowance for freeboard above the design of the structure.

MAINTENANCE AND REPAIR

§ 105.261. MAINTENANCE AND REPAIR OF LEVEES OR FLOODWALLS

(a) The owner of any levee or floodwall shall inspect the levee or floodwall and all appurtenant structures, including drainage facilities, at least annually and shall keep records thereof, which shall be available to the Department on request.

(b) The owner of any levee or floodwall shall at all times properly maintain the levee or floodwall and all appurtenant structures.

(c) Trees and other vegetation with deep roots shall not be allowed on any levee used for flood control purposes and vegetation shall at all times be controlled.

§ 105.262. MAINTENANCE OF FILLS

Fills shall at all times be maintained in a manner to prevent erosion and to assure the stability of the slopes.

3. A complete hydraulic and hydrologic report on the pr[illegible] including, if the Department so requires, a backwater analysis of the [illegible] record.

4. Stream profiles, showing the bed slope [illegible] elevations for points 1,000 feet upstream and sufficiently far downstream [illegible] than 1,000 feet downstream.

5. The type of all materials to be used on the fill, levee or similar [illegible]

6. Plans for the protection of the fill, levee or similar structure from erosion, both during and after construction [illegible]

7. [illegible]

8. A copy of the local flood plain management regulations or ordinances.

9. [illegible]

[illegible]

[illegible] will not be approved by the Department where:

[illegible] and flood easements or flood protection has not been [illegible]

[illegible] It will create erosive velocities in the st[illegible] protection has not been provided;

[illegible] It will increase flood damages downstream through a loss of flood [illegible]

[illegible] It is designed for a discharge less than the 100-year flood.

§ [illegible]

No solid waste of any type shall be used in the construction of fills, levees or similar structures, except in accordance with the provisions of the [illegible] Act and Chapter [illegible] of this title (relating to solid waste management).

Appendix 7

DREDGING REGISTER

Information recorded for each of the 97 dredging locations presently listed in the register includes:

1. Identification Code

   i. Location which can be the sum of several separate projects in the immediate harbour or channel area;

   ii. Jurisdiction - Ontario or one of the eight Great Lakes states;

   iii. Basin - one of the five Great Lakes basins. Interconnecting waters and channels are included in the basin immediately downstream, e.g. Lake St. Clair is included in the Lake Erie basin;

   iv. Dates - the year and month in which the project began and was completed.

2. Physical Data

   i. Material type - sand, silt, clay, rock, gravel, boulder, organics, peat, debris (see Table 12 of text for characteristics);

   ii. Equipment type - clam, dipper, backhoe, hydraulic and hopper (see the following section on Dredging Plant and Practices);

   iii. Disposal method -

      a) upland - development of upland habitat, either on new disposal sites or by reclaiming old sites.

      b) confined (dyked) - confining materials on land or in shallow water next to land.

      c) beach (nourishment) - clean, dredged sand is ideal for nourishing beaches which have been eroded by wave action.

      d) open lake - designated open-water dumping locations.

      e) reuse - dredged materials can be used in construction, industry, winter road sanding to increase traction, landfill cover, fill material for development and reclamation of strip-mined areas.

iv. Quantity (CMPM) - CMPM = cubic metres place material

a) pay - actual amount of material approved for excavation plus over depth.

b) total - includes the pay material plus material removed through scouring and from outside the approved dredging area;

c) dry density (kg/L)

v. Costs

a) capital containment - costs to provide a disposal site;

b) O&M containment - costs to operate and maintain a disposal site;

c) dredging $/CMPM - costs of the actual dredging operation in dollars per cubic metre place material; and

d) total $/CMPM - total costs (a-c) of a dredging project.

vi. Remarks - used for additional information, e.g. site and equipment description.

3. <u>Chemical Data (dry weight)</u>

i. Mean, Minimum (Min), and Maximum (Max) concentrations are listed for 14 chemical parameters. It should be noted that some of the chemical data are reported as less than (<) values and will also affect load calculations. Data are averaged over the areas dredged. If specific dredging locations were not known, data were averaged over the entire harbour and this was noted in the remarks portion of the description.

ii. Load (T) is calculated by: $D \times Q \times C = T$

where D = dry density (kg/L),
Q = quantity of material (CMPM),
C = weighted average concentration, how calculated,
T = load (tonnes)

iii. The 15 chemical parameters listed are:

volatile solids (%) or loss on ignition at 600°C

O&G - Oil and Grease	COD - Chemical Oxygen Demand
NH_3 - Ammonia	TKN - Total (Kjeldahl) Nitrogen (as N)
Hg - Mercury	Total P - Total Phosphorus (as P)
As - Arsenic	Pb - Lead
Cu - Copper	Cd - Cadmium
Cr - Chromium	Zn - Zinc
PCB - Polychlorinated Biphenyls	Ni - Nickel

iv. Other parameters - identification of other parameters for which data are available.

v. Sampling dates - identification of the date(s) on which the sample was taken and by whom.

ABBREVIATIONS USED IN THE REGISTER

AVG	- Averaged	MN	- Minnesota
BAS	- Basin	WI	- Wisconsin
BTWN	- Between	IL	- Illinois
CH	- Channel	IN	- Indiana
ENT	- Entrance	MI	- Michigan
DRGED	- Dredged	OH	- Ohio
LIM	- Limit	PA	Pennsylvania
HBR	- Harbour	NY	- New York
MID	- Middle	ON	- Ontario
OUT	- Outer		
PT, PTS	- Point(s)		
RI, RIV	- River		
UP, UPSTM	- Upstream		
N, S, E, W	- Directions		
M	- Mile		

DATA SOURCES

The basic data for the dredging register were submitted by federal and provincial agencies responsible for dredging and its related environmental effects. The following identifies the sources of the data and the principal contacts in each country. If further information or classification of entries is required, the appropriate person in the following list should be contacted.

Canada

The Canadian physical data were submitted by:

Marine and Civil Resources
Department of Public Works
Ontario Region
4900 Yonge St.
Toronto, Ontario M2N 6A6

Contact: Mr. Ansar Khan
(416) 224-4119

The Canadian chemical data were submitted by:

Water Resources Branch
Ontario Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario M4V 1P5

Contact: Mr. Deo Persaud
(416) 965-6954

and

Environmental Protection Service
Environment Canada, Ontario Region
25 St. Clair Avenue East
Toronto, Ontario M4T 1M2

Contact: Mr. Harry Beach
(416) 966-5840

United States

The U.S. physical and some chemical data were submitted by:

North Central Division
U.S. Army Corps of Engineers
536 South Clark Street
Chicago, Illinois 60605

Contacts: Mr. Carl Cable
(312) 353-6372

Mr. Robert Neal
(312) 353-6378

Most U.S. chemical data were submitted by:

Great Lakes National Program Office
U.S. Environmental Protection Agency, Region V
536 South Clark Street
Chicago, Illinois 60605

Contact: Mr. Anthony Kizlauskas
(312) 353-3576

DREDGING PLANT AND PRACTICES*

The dredging process involves four basic actions:

- loosening or dislodging of the material to be removed,
- excavation and lifting to the water surface,
- transportation to a disposal site, and
- disposal.

The loosening or dislodging action is by mechanical penetrating and grabbing, raking or cutting, drilling and blasting, or hydraulic scouring. The lifting action is accomplished by vertical hoisting utilizing cables or hydraulic power, by inclined hoisting employing an endless-belt principle or

*International Working Group on the Abatement and Control of Pollution from Dredging Activities. Report, 1975.

by hydraulic suction. The transporting is done by pipelines, scows, hopper dredges, trucks, or by overcasting. The disposal function of the operation is accomplished by discharging from a pipeline, dumping from trucks, bottom dumping or by pumping out of scows or hoppers. In some hydraulic dredging operations the four actions are carried out continuously and concurrently by a single piece of equipment while other methods employ two or more units and perform the several actions separately and intermittently.

Dredging plant and practices have been developed over time to achieve maximum economic returns through output optimization with little regard having been given to environmental concerns. Thus the type of equipment used and the method adopted to perform a dredging operation in the most efficient and economic manner has traditionally been selected on the basis of the following factors:

- the classification of the material to be dredged,
- the physical environment at the dredging site,
- the dredging depth,
- the location and nature of the dredged-material disposal site, and
- the availability of suitable dredging plant.

However, since it is now recognized that dredging operations can have an adverse environmental impact, particularly when it is necessary to excavate and dispose of grossly contaminated sediments, the various aspects of environmental concern reviewed in this report will in future need to be considered when selecting plant and operating procedures.

Unfortunately, there are few actual experience data upon which to base analytical evaluations of the environmental effects of dredging. Neither is there much comparative information available for assessing the relative performance of different types of dredging equipment in environmental terms. It is apparent from visual observations of turbidity in the area of dredging operations that losses of fine materials take place during excavation. One measure of the extent of disturbance caused would be indicated from the percentage loss of such fine materials but direct determination of such data is scarcely practical. Since different types of dredging plant have vastly different operating characteristics, even the comparative effects between them are difficult to establish. A modern cutter-suction dredge, which may handle up to 3,000 m^3 per hour, cannot be compared directly with a 3 m^3 clamshell dredge operating efficiently at a production rate of 120 m^3 per hour. Which will result in the greater aggregate loss of fines is not really known.

Maintenance dredging projects usually deal with recent accumulations of sediments which may have been contaminated. They are more likely, therefore, to give rise to adverse and intense short-term pollution effects than would capital works projects. The latter normally involve significant physical changes to bottom site geometry which induce long-term influences in the environs of the dredging site. Any dredging operation may impose a combination of both short- and long-term environmental impacts at the dredging site.

Comparison of the operating cycles and procedures for the various types of dredging plant used in the Great Lakes is of interest insofar as it is possible to distinguish differences in impact intensities which relate to specific types of equipment and particular operating practices. The choice of dredging plant generally has less influence upon long-term dysfunctional effects, although some may be inferred from changes in bathymetry and substrate disturbances which can be related to typical dredging operations.

Dredging Plant

Dredging plant is broadly categorized as mechanical, hydraulic or pneumatic equipment. As the designation implies, mechanical dredges accomplish the digging of bottom sediments through the direct application of mechanical force to dislodge and remove the material. Most mechanical dredges deliver the dredged material into scows for transportation to the disposal site. Specialized mechanical dredges include the dipper dredge, the bucket ladder dredge and the grab or clamshell dredge all of which are used extensively in the Great Lakes waterways.

Hydraulic dredges operate on the principle of the centrifugal water pump. The pressure difference across the impellor creates a water velocity sufficient to transport a slurry of the material being dredged through a pipeline for deposit at the disposal site. Mixtures containing 15 to 20 percent of material by volume are usual. Suction dredges, hopper dredges and cutter-suction dredges are examples of hydraulic plant utilized in the Great Lakes.

Pneumatic dredges are a recent, European-patented innovation and have not yet been introduced into North America. The dredge operates on compressed air and hydrostatic pressure and is reported to be capable of entraining mixtures of material and water containing up to 50 percent solids by volume.

Mechanical Dredging Plant

Grab or Clamshell Dredges

The grab or clamshell is the most commonly used mechanical dredging plant in the Great Lakes fleet with application to a wide range of maintenance and new-work projects. It may be used to excavate all types of materials except for the most-cohesive sediments and solid rock. Grab and clamshell dredges are frequently employed for maintenance dredging operations and are particularly adapted to operating within confined areas and where close control of position and depth is essential to avoid undermining the foundations of marine structures. The excavation is accomplished as an intermittent operation and results in a somewhat irregular and disturbed bottom surface.

In practice, the clamshell usually excavates a heaped bucket of material. During hoisting, drag forces wash away part of the load and once the bucket clears the water surface additional losses occur through rapid drainage of entrapped water and slumping of the material heaped above the bucket rim. The bucket may be inadvertently prevented from fully closing by random pieces of timber, large roots, boulders or rubble fragments, and if it remains ajar, much of its load may be lost during hoisting. Losses of material throughout the process are also influenced by the fit and condition of the bucket and the hoisting speed, and can vary widely between different types of material. Even when fully closed, substantial losses of loose and fine sediment can occur.

Hydraulic-operated Clamshell and Backhoe Dredges

A modification of the grab dredge, the hydraulically-operated clamshell and backhoe dredges are essentially land-based excavators that are particularly useful for nearshore operations. They have the advantages of providing controlled penetration of sediments independently of bucket weight and of short operating cycles but, on the other hand, have limited depth capabilities. Backhoes dredge in the backwards direction but, by reversing the bucket, can be used as hydraulically-operated dipper dredges.

Dragline Dredges

Usually operated also from a land site, the dragline dredge is basically a crane equipped with a suitable drag bucket. A long boom or deadman post is used to swing the bucket into place over the sediments to be excavated where it is released and sinks to the bed. It is then dragged along the bottom back to the disposal site at which the crane is located. Such dredges can also be operated from barges in which case the bucket is raised and the material dumped into an adjacent scow. Dragline dredges tend to displace much more material than they excavate in each digging cycle.

Dipper Dredges

Dipper dredges are capable of exerting great mechanical effort and hence find application in the sub-aqueous excavation of soft or broken rock and dense sedimentary deposits such as boulder clay and glacial till. Unlike the grab dredges, the bucket is firmly attached to a long boom and is forced into the material to be removed. To increase the digging power, the dredge barge is suspended on powered spuds that transfer the weight of the front portion of the vessel to the river bed.

The violent action of this type of dredge causes considerable disturbance during digging and there is also a significant loss of material from the bucket as it is raised. However, such losses are almost inevitable in dredging the dense, cohesive sediments for which such plant is primarily utilized.

Hydraulic Dredging Plant

Plain Suction Dredges

This is the simplest form of hydraulic dredge and is used primarily for excavating freely-flowing materials. The dredge consists essentially of a barge-mounted centrifugal pump and a pipeline. Materials from the bottom are drawn up through the suction line and discharged into a scow or to a nearby disposal site. Plain suction dredges are commonly used for sand mining, sand bypassing, beach restoration, general river channel maintenance, and scow unloading.

Trailing-suction Hopper Dredges

The trailing-arm hopper dredge is a plain suction dredge mounted on a self-propelled vessel instead of on a barge. The suction intake pipe is dragged along the bed of the area to be dredged as the vessel is moved forward at speeds of up to 5 or 6 km/h and the dredgings discharged into hoppers located in the hull. Pumping normally continues until an economic load has been accumulated in the hoppers. In the process, excess water containing a proportion of the finer constituents of the material being dredged overflows the top of the hoppers and returns to the waterbody.

Although at nearshore locations the dredged material can be pumped ashore, the principal value of the dredge is that it is self-contained, and can therefore operate well away from the material disposal site with minimum disruption to navigation. While specifically designed dragheads can be used for raking hard materials, the dredge is particularly efficient for excavating loose, cohesionless materials.

Where open-water disposal of the dredged material is permitted, the vessel turns slowly across the disposal site as the hoppers are opened for bottom dumping. Many hopper dredges have been modified in recent years to provide for direct pump-out to an onshore disposal area.

About 75 percent of the Great Lakes maintenance dredging in the United States has been performed with hopper dredges belonging to the Corps of Engineers. They are not common in the Canadian fleet.

Cutter-suction Dredges

An improved version of the plain suction dredge, the cutter-suction dredge is equipped with a powered cutterhead at the intake to break up dense material and create a slurry that can be more readily transported. The largest units can excavate up to 3,000 m^3 per hour and deliver the material to a disposal site through 3,000 m of pipeline. Booster pumps can be installed in the discharge line to allow continuous transport over greater distances.

To assist in the dredging action, two spuds are provided at the stern of the dredge and swinging cables are used to pivot the vessel about either spud, thus controlling movement of the intake into the material being excavated. The intake and cutterhead are attached to a rigid-frame ladder that is pivoted about the front of the barge for control of dredging depth.

Cutter-suction equipment is the most-widely used hydraulic dredging plant in the Great Lakes Canadian fleet. Its range of characteristics, both in unit capacity and adaptability to different classes of material, make it a most versatile dredge. Cutterheads have rotation speeds ranging between 5 and 40 rpm but are commonly operated at 15 to 25 rpm in the Great Lakes waterways. DC-drive motors are used in some dredges to provide for continuously variable speed control. While this feature is not widely available, instances have been noted when production was improved by an ability to decrease the rotational speed of the cutterhead in loose sandy material. Different types of cutterhead are used to dredge materials ranging from very fine-grained sediments to soft rock.

Dustpan Dredges

Although similar in configuration to a cutter-suction dredge, the basic dustpan dredge provides for agitation of the sediment by powerful, high-pressure water jets distributed over the length of the dustpan head. During operation, anchors are placed upstream of the dredging area and the vessel is pulled along by reeling in the anchor cables. Because of the wide head configuration, it is possible to obtain a higher solids content in freely-flowing materials than with other hydraulic suction plant. While the practice of jetting no doubt improves efficiency, a side effect is the considerable resuspension of fine-grained materials that escape from the suction head.

Pneumatic Dredging Plant

The "Pneuma" System dredge has recently been developed in Europe but has not yet been introduced into North America. The equipment which usually consists of a cluster of three large diameter air-operated pump chambers discharging via pipeline, operates through positive displacement action. Pneuma equipment has particular application to mining-type operations in freely-flowing material and is capable of operating in very deep water. Observations indicate considerable variability of loading, although slurry concentrations averaging between 30 and 40 percent solids content are achieved. Development and testing of variations of the basic system, which may give rise to modifications suitable for other applications, are being pursued in Europe and Japan.

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Appendix 7.1

TOTAL VOLUME OF DREDGED MATERIAL

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: ALL

RANK	JURIS	LOCATION	1975 VOLUME	1975 # OF PROJ	1976 VOLUME	1976 # OF PROJ	1977 VOLUME	1977 # OF PROJ	1978 VOLUME	1978 # OF PROJ	1979 VOLUME	1979 # OF PROJ	TOTAL VOLUME	TOTAL # OF PROJ
1	OH	TOLEDO HARBOR	1639067	5	370325	2	649488	4	912504	5	578273	5	4149657	21
2	OH	CUYAHOGA RIVER & CLEVELAND HBR	308973	2	501290	2	547246	3	147996	2	650872	3	2156377	12
3	OH	L. ERIE SAILING C. MICH & OHIO	0	0	1170582	2	0	0	0	0	0	0	1170582	2
4	MI	SAGINAW	70138	1	0	0	81239	1	627068	2	300974	3	1079419	7
5	NY	ROCHESTER HARBOR	200539	1	226615	2	103601	1	246502	1	216155	1	993412	6
6	NY	BUFFALO HARBOR	133626	1	173664	1	359729	2	183839	1	92066	3	942924	8
7	WI	GREEN BAY HARBOR	189193	1	0	0	244367	1	160700	1	339333	1	933593	4
8	OH	SANDUSKY HARBOR	423414	2	102686	1	97398	2	0	0	99354	1	722852	6
9	OH	HURON HARBOR	84679	1	131531	1	356900	1	0	0	136740	2	709850	5
10	MI	MONROE	0	0	8630	1	123151	1	230388	2	296437	1	658606	5
11	OH	FAIRPORT HARBOR	43463	1	175902	3	68883	2	166302	4	148033	2	602583	12
12	ON	THUNDER BAY	82900	1	0	0	425700	2	75400	1	0	0	584000	4
13	WI	MILWAUKEE HARBOR	126605	1	234604	1	43341	1	159334	1	0	0	563884	4
14	MN	DULUTH-SUPERIOR HARBOR	99500	1	25100	2	135900	3	147500	2	78070	2	486070	10
15	OH	ASHTABULA HARBOR	223156	1	98717	1	98285	2	38750	1	12696	1	471604	6
16	OH	CONNEAUT HARBOR	304886	2	63777	1	60403	1	21715	1	18514	1	469295	6
17	MI	ST. JOSEPH	46299	1	62619	1	120403	1	85251	3	98074	2	412646	8
18	MI	ROUGE RIVER	75209	1	75353	1	48808	1	119803	2	89145	1	408318	6
19	PA	ERIE HARBOR	142980	1	116892	1	97172	1	0	0	22145	1	379189	4
20	ON	S.E. BEND CUTOFF	0	0	0	0	0	0	332400	1	0	0	332400	1
21	ON	HAMILTON	0	0	127766	1	0	0	146200	2	0	0	273966	3
22	OH	LORAIN HARBOR	78160	1	24695	2	17629	1	0	0	122489	2	242973	6
23	ON	PORT STANLEY	48855	1	0	0	189000	2	0	0	0	0	237855	3
24	MI	ONTONAGON HARBOR	40753	2	87911	2	56629	3	45210	1	0	0	230503	8
25	IL	CALUMET HARBOR & RIVER	58553	1	0	0	151298	1	14009	1	0	0	223860	3
26	MI	GRAND HAVEN	49656	1	31882	1	12437	1	73883	3	53221	1	221079	7
27	ON	GODERICH	129600	1	0	0	0	0	0	0	72800	1	202400	2
28	MI	DETROIT RIVER CHANNELS	0	0	0	0	0	0	0	0	189499	2	189499	2
29	NY	OSWEGO HARBOR	82979	1	30737	1	53803	1	0	0	21398	1	188917	4
30	ON	WHITBY	0	0	0	0	0	0	188300	1	0	0	188300	1
31	MI	MUSKEGON	48145	1	29188	1	57482	1	23954	1	21348	1	180117	5
32	ON	OSHAWA	0	0	0	0	10200	1	99500	2	61000	1	170700	4
33	MI	MANISTEE	28658	1	16124	1	25749	1	33105	1	23379	1	127015	5
34	MI	KEWEENAW WATERWAY	62500	1	63700	1	0	0	0	0	0	0	126200	2
35	WI	MANITOWOC HARBOR	0	0	29627	1	52390	1	11240	1	11698	1	104955	4
36	MI	SOUTH HAVEN	34247	1	62619	1	0	0	0	0	0	0	96866	2
37	MI	ST. CLAIR RIVER	19377	1	0	0	18964	1	28042	1	29785	1	96168	4
38	MI	HOLLAND	0	0	23114	1	18043	1	31775	1	22958	1	95890	4
39	WI	KENOSHA HARBOR	0	0	49219	1	42022	1	0	0	0	0	91241	2
40	MI	LITTLE LAKE	0	0	28107	1	9906	1	28133	1	16995	1	83141	4
41	MI	HARRISVILLE	0	0	0	0	44745	1	0	0	23085	1	67830	2
42	ON	SARNIA	0	0	0	0	67800	1	0	0	0	0	67800	1
43	MI	WHITE LAKE	29583	1	36990	1	0	0	0	0	0	0	66573	2
44	MI	LELAND	5319	1	20105	1	15624	1	10386	1	13252	1	64686	5
45	IL	WAUKEGAN HARBOR	0	0	64498	2	0	0	0	0	0	0	64498	2
46	ON	TORONTO HARBOUR	44100	1	0	0	3662	1	13341	1	3392	1	64495	4
47	ON	COBOURG	0	0	33592	1	16000	1	14400	1	0	0	63992	3
48	MI	LUDINGTON	36194	2	6171	1	20339	1	0	0	0	0	62704	4
49	ON	WHEATLEY	0	0	59000	1	0	0	0	0	0	0	59000	1
50	IN	MICHIGAN CITY HARBOR	0	0	0	0	0	0	43073	1	14669	1	57742	2
51	ON	KINGSVILLE	0	0	0	0	51200	2	0	0	0	0	51200	2
52	MI	GRAND TRAVERSE BAY HARBOR	9861	2	20762	2	0	0	12865	1	2707	1	46195	6
53	MI	BOLLES HARBOR	0	0	0	0	0	0	40187	1	0	0	40187	1
54	MI	FRANKFORT	0	0	0	0	6869	1	16131	1	16087	1	39087	3

55	OH	VERMILION	3731	1	0	0	0	0	4338	1	24627	2	32696	4
56	MI	PENTWATER	0	0	7105	1	0	0	15355	1	9323	1	31783	3
57	NY	BLACK ROCK CHANNEL & TONAWANDA	1095	1	0	0	0	0	8869	1	20721	2	30685	4
58	OH	ROCKY RIVER	0	0	29284	1	0	0	0	0	0	0	29284	1
59	ON	RUSCOM RIVER	0	0	0	0	0	0	28410	1	0	0	28410	1
60	ON	PORT HOPE	0	0	0	0	0	0	0	0	28000	1	28000	1
61	MI	BIG BAY	3564	1	9441	1	4022	1	8726	1	1362	1	27115	5
62	NY	OGDENSBURG HARBOR	0	0	0	0	26703	1	0	0	0	0	26703	1
63	MI	BLACK RIVER (UP)	3770	1	7712	1	0	0	5199	1	8563	1	25244	4
64	ON	BAYFIELD	25200	1	0	0	0	0	0	0	0	0	25200	1
65	ON	GRAND BEND	10000	1	0	0	0	0	15100	1	0	0	25100	2
66	MI	ARCADIA	0	0	9611	1	5186	1	3503	1	4574	1	22874	4
67	ON	PIKE CREEK	0	0	0	0	19600	1	0	0	0	0	19600	1
68	MN	TWO HARBORS	0	0	19200	1	0	0	0	0	0	0	19200	1
69	MI	PORTAGE LAKE	0	0	3272	1	15292	1	0	0	0	0	18564	2
70	ON	CHENAL ECARTE	0	0	0	0	0	0	0	0	18100	1	18100	1
71	MI	ST. MARYS RIVER	0	0	16576	1	0	1	0	1	0	1	16576	4
72	MI	BIG BAY HARBOR	4900	1	6000	1	4700	1	0	0	0	0	15600	3
73	ON	GOULAIS RIVER	0	0	0	0	0	0	14800	1	0	0	14800	1
74	MI	SEBEWAING	0	0	0	0	14738	1	0	0	0	0	14738	1
75	NY	DUNKIRK HARBOR	14233	1	0	0	0	0	0	0	0	0	14233	1
76	MI	BLACK RIVER HARBOR	0	0	8900	1	5200	1	0	0	0	0	14100	2
77	MI	CHARLEVOIX	11149	1	0	0	0	0	0	0	0	0	11149	1
78	ON	PUCE RIVER	0	0	0	0	0	0	11142	1	0	0	11142	1
79	WI	PORT WASHINGTON HARBOR	0	0	0	0	11063	1	0	0	0	0	11063	1
80	WI	CORNUCOPIA HARBOR	0	0	4800	1	0	0	0	0	6200	1	11000	2
81	ON	PORT CREDIT	4700	1	0	0	4600	1	0	0	0	0	9300	2
82	NY	GREAT SODUS BAY HARBOR	8278	1	0	0	0	0	0	0	0	0	8278	1
83	ON	PORT ELGIN	0	0	0	0	0	0	7800	1	0	0	7800	1
84	NY	WILSON HARBOR	0	0	0	0	6837	1	0	0	0	0	6837	1
85	MI	CHEBOYGAN	0	0	6830	1	0	0	0	0	0	0	6830	1
86	ON	MITCHELL'S BAY	0	0	0	0	0	0	5780	1	0	0	5780	1
87	MI	SAUGATUCK	0	0	1084	1	0	0	4139	1	0	0	5223	2
88	ON	POINT TRAVERSE	0	0	4800	1	0	0	0	0	0	0	4800	1
89	MI	LAC LABELLE	798	1	0	0	0	0	0	0	3925	1	4723	2
90	ON	LITTLE CURRENT	0	0	0	0	0	0	0	0	3700	1	3700	1
91	ON	HURKETT	0	0	0	0	0	0	0	0	3300	1	3300	1
92	ON	VIDAL SHOALS	0	0	3154	1	0	0	0	0	0	0	3154	1
93	WI	LAPOINT HARBOR	0	0	2600	1	0	0	0	0	0	0	2600	1
94	MN	KNIFE RIVER HARBOR	1910	1	0	0	0	0	0	0	0	0	1910	1
95	ON	LONG POINT (AMHERST ISLAND)	0	0	0	0	0	0	1800	1	0	0	1800	1
96	NY	LITTLE SODUS BAY HARBOR	1612	1	0	0	0	0	0	0	0	0	1612	1
97	MN	GRAND MARAIS	1350	1	0	0	0	0	0	0	0	0	1350	1
TOTAL			5097457	59	4524463	63	4721746	67	4664147	67	4029038	64	23036851	320

SUMMARY OF DREDGED MATERIAL (CMPM) BY BASIN 1975-1979

BASIN	UNITED STATES	CANADA	TOTAL
SUPERIOR	1080851	605254	1686105
MICHIGAN	3513922	0	3513922
HURON	1192663	332000	1524663
ERIE	13517562	763487	14281049
ONTARIO	1225759	805353	2031112
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TOTAL	20530757	2506094	23036851

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: SUPERIOR

RANK	JURIS	LOCATION	1975 VOLUME	1975 # OF PROJ	1976 VOLUME	1976 # OF PROJ	1977 VOLUME	1977 # OF PROJ	1978 VOLUME	1978 # OF PROJ	1979 VOLUME	1979 # OF PROJ	TOTAL VOLUME	TOTAL # OF PROJ
1	ON	THUNDER BAY	82900	1	0	0	425700	2	75400	1	0	0	584000	4
2	MN	DULUTH-SUPERIOR HARBOR	99500	1	25100	2	135900	3	147500	2	78070	2	486070	10
3	MI	ONTONAGON HARBOR	40753	2	87911	2	56629	3	45210	1	0	0	230503	8
4	MI	KEWEENAW WATERWAY	62500	1	63700	1	0	0	0	0	0	0	126200	2
5	MI	LITTLE LAKE	0	0	28107	1	9906	1	28133	1	16995	1	83141	4
6	MI	GRAND TRAVERSE BAY HARBOR	9861	2	20762	2	0	0	12865	1	2707	1	46195	6
7	MI	BIG BAY	3564	1	9441	1	4022	1	8726	1	1362	1	27115	5
8	MI	BLACK RIVER (UP)	3770	1	7712	1	0	0	5199	1	8563	1	25244	4
9	MN	TWO HARBORS	0	0	19200	1	0	0	0	0	0	0	19200	1
10	MI	BIG BAY HARBOR	4900	1	6000	1	4700	1	0	0	0	0	15600	3
11	ON	GOULAIS RIVER	0	0	0	0	0	0	14800	1	0	0	14800	1
12	WI	CORNUCOPIA HARBOR	0	0	4800	1	0	0	0	0	6200	1	11000	2
13	MI	LAC LABELLE	798	1	0	0	0	0	0	0	3925	1	4723	2
14	ON	HURKETT	0	0	0	0	0	0	0	0	3300	1	3300	1
15	ON	VIDAL SHOALS	0	0	3154	1	0	0	0	0	0	0	3154	1
16	WI	LAPOINT HARBOR	0	0	2600	1	0	0	0	0	0	0	2600	1
17	MN	KNIFE RIVER HARBOR	1910	1	0	0	0	0	0	0	0	0	1910	1
18	MN	GRAND MARAIS	1350	1	0	0	0	0	0	0	0	0	1350	1

SUMMARY OF DREDGED MATERIAL (CMPM) 1975-1979

YEAR	UNITED STATES	CANADA	TOTAL
1975	228906	82900	311806
1976	275333	3154	278487
1977	211157	425700	636857
1978	247633	90200	337833
1979	117822	3300	121122
TOTAL	1080851	605254	1686105

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: MICHIGAN

RANK	JURIS	LOCATION	1975 VOLUME	1975 # OF PROJ	1976 VOLUME	1976 # OF PROJ	1977 VOLUME	1977 # OF PROJ	1978 VOLUME	1978 # OF PROJ	1979 VOLUME	1979 # OF PROJ	TOTAL VOLUME	TOTAL # OF PROJ
1	WI	GREEN BAY HARBOR	189193	1	0	0	244367	1	160700	1	339333	1	933593	4
2	WI	MILWAUKEE HARBOR	126605	1	234604	1	43341	1	159334	1	0	0	563884	4
3	MI	ST. JOSEPH	46299	1	62619	1	120403	1	85251	3	98074	2	412646	8
4	IL	CALUMET HARBOR & RIVER	58553	1	0	0	151298	1	14009	1	0	0	223860	3
5	MI	GRAND HAVEN	49656	1	31882	1	12437	1	73883	3	53221	1	221079	7
6	MI	MUSKEGON	48145	1	29188	1	57482	1	23954	1	21348	1	180117	5
7	MI	MANISTEE	28658	1	16124	1	25749	1	33105	1	23379	1	127015	5
8	WI	MANITOWOC HARBOR	0	0	29627	1	52390	1	11240	1	11698	1	104955	4
9	MI	SOUTH HAVEN	34247	1	62619	1	0	0	0	0	0	0	96866	2
10	MI	HOLLAND	0	0	23114	1	18043	1	31775	1	22958	1	95890	4
11	WI	KENOSHA HARBOR	0	0	49219	1	42022	1	0	0	0	0	91241	2
12	MI	WHITE LAKE	29583	1	36990	1	0	0	0	0	0	0	66573	2
13	MI	LELAND	5319	1	20105	1	15624	1	10386	1	13252	1	64686	5
14	IL	WAUKEGAN HARBOR	0	0	64498	2	0	0	0	0	0	0	64498	2
15	MI	LUDINGTON	36194	2	6171	1	20339	1	0	0	0	0	62704	4
16	IN	MICHIGAN CITY HARBOR	0	0	0	0	0	0	43073	1	14669	1	57742	2
17	MI	FRANKFORT	0	0	0	0	6869	1	16131	1	16087	1	39087	3
18	MI	PENTWATER	0	0	7105	1	0	0	15355	1	9323	1	31783	3
19	MI	ARCADIA	0	0	9611	1	5186	1	3503	1	4574	1	22874	4
20	MI	PORTAGE LAKE	0	0	3272	1	15292	1	0	0	0	0	18564	2
21	MI	CHARLEVOIX	11149	1	0	0	0	0	0	0	0	0	11149	1
22	WI	PORT WASHINGTON HARBOR	0	0	0	0	11063	1	0	0	0	0	11063	1
23	MI	CHEBOYGAN	0	0	6830	1	0	0	0	0	0	0	6830	1
24	MI	SAUGATUCK	0	0	1084	1	0	0	4139	1	0	0	5223	2

SUMMARY OF DREDGED MATERIAL (CMPM) 1975-1979

YEAR	UNITED STATES	CANADA	TOTAL
1975	663601	0	663601
1976	694662	0	694662
1977	841905	0	841905
1978	685838	0	685838
1979	627916	0	627916
TOTAL	3513922	0	3513922

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: HURON

RANK	JURIS	LOCATION	1975 VOLUME	1975 # OF PROJ	1976 VOLUME	1976 # OF PROJ	1977 VOLUME	1977 # OF PROJ	1978 VOLUME	1978 # OF PROJ	1979 VOLUME	1979 # OF PROJ	TOTAL VOLUME	TOTAL # OF PROJ
1	MI	SAGINAW	70138	1	0	0	81239	1	627068	2	300974	3	1079419	7
2	ON	GODERICH	129600	1	0	0	0	0	0	0	72800	1	202400	2
3	MI	HARRISVILLE	0	0	0	0	44745	1	0	0	23085	1	67830	2
4	ON	SARNIA	0	0	0	0	67800	1	0	0	0	0	67800	1
5	ON	BAYFIELD	25200	1	0	0	0	0	0	0	0	0	25200	1
6	ON	GRAND BEND	10000	1	0	0	0	0	15100	1	0	0	25100	2
7	MI	ST. MARYS RIVER	0	0	16576	1	0	1	0	1	0	1	16576	4
8	MI	SEBEWAING	0	0	0	0	14738	1	0	0	0	0	14738	1
9	MI	BLACK RIVER HARBOR	0	0	8900	1	5200	1	0	0	0	0	14100	2
10	ON	PORT ELGIN	0	0	0	0	0	0	7800	1	0	0	7800	1
11	ON	LITTLE CURRENT	0	0	0	0	0	0	0	0	3700	1	3700	1

SUMMARY OF DREDGED MATERIAL (CMPM) 1975-1979

YEAR	UNITED STATES	CANADA	TOTAL
1975	70138	164800	234938
1976	25476	0	25476
1977	145922	67800	213722
1978	627068	22900	649968
1979	324059	76500	400559
TOTAL	1192663	332000	1524663

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: ERIE

			1975		1976		1977		1978		1979		TOTAL	
RANK	JURIS	LOCATION	VOLUME	# OF PROJ	VOLUME	# OF PROJ	VOLUME	# OF PROJ	VOLUME	# OF PROJ	VOLUME	# OF PROJ	VOLUME	# OF PROJ
1	OH	TOLEDO HARBOR	1639067	5	370325	2	649488	4	912504	5	578273	5	4149657	21
2	OH	CUYAHOGA RIVER & CLEVELAND HBR	308973	2	501290	2	547246	3	147996	2	650872	3	2156377	12
3	OH	L. ERIE SAILING C. MICH & OHIO	0	0	1170582	2	0	0	0	0	0	0	1170582	2
4	NY	BUFFALO HARBOR	133626	1	173664	1	359729	2	183839	1	92066	3	942924	8
5	OH	SANDUSKY HARBOR	423414	2	102686	1	97398	2	0	0	99354	1	722852	6
6	OH	HURON HARBOR	84679	1	131531	1	356900	1	0	0	136740	2	709850	5
7	MI	MONROE	0	0	8630	1	123151	1	230388	2	296437	1	658606	5
8	OH	FAIRPORT HARBOR	43463	1	175902	3	68883	2	166302	4	148033	2	602583	12
9	OH	ASHTABULA HARBOR	223156	1	98717	1	98285	2	38750	1	12696	1	471604	6
10	OH	CONNEAUT HARBOR	304886	2	63777	1	60403	1	21715	1	18514	1	469295	6
11	MI	ROUGE RIVER	75209	1	75353	1	48808	1	119803	2	89145	1	408318	6
12	PA	ERIE HARBOR	142980	1	116892	1	97172	1	0	0	22145	1	379189	4
13	OH	S.E. BEND CUTOFF	0	0	0	0	0	0	332400	1	0	0	332400	1
14	OH	LORAIN HARBOR	78160	1	24695	2	17629	1	0	0	122489	2	242973	6
15	ON	PORT STANLEY	48855	1	0	0	189000	2	0	0	0	0	237855	3
16	MI	DETROIT RIVER CHANNELS	0	0	0	0	0	0	0	0	189499	2	189499	2
17	MI	ST. CLAIR RIVER	19377	1	0	0	18964	1	28042	1	29785	1	96168	4
18	ON	WHEATLEY	0	0	59000	1	0	0	0	0	0	0	59000	1
19	ON	KINGSVILLE	0	0	0	0	51200	2	0	0	0	0	51200	2
20	MI	BOLLES HARBOR	0	0	0	0	0	0	40187	1	0	0	40187	1
21	OH	VERMILION	3731	1	0	0	0	0	4338	1	24627	2	32696	4
22	NY	BLACK ROCK CHANNEL & TONAWANDA	1095	1	0	0	0	0	8869	1	20721	2	30685	4
23	OH	ROCKY RIVER	0	0	29284	1	0	0	0	0	0	0	29284	1
24	ON	RUSCOM RIVER	0	0	0	0	0	0	28410	1	0	0	28410	1
25	ON	PIKE CREEK	0	0	0	0	19600	1	0	0	0	0	19600	1
26	ON	CHENAL ECARTE	0	0	0	0	0	0	0	0	18100	1	18100	1
27	NY	DUNKIRK HARBOR	14233	1	0	0	0	0	0	0	0	0	14233	1
28	ON	PUCE RIVER	0	0	0	0	0	0	11142	1	0	0	11142	1
29	ON	MITCHELL'S BAY	0	0	0	0	0	0	5780	1	0	0	5780	1

SUMMARY OF DREDGED MATERIAL (CMPM) 1975-1979

YEAR	UNITED STATES	CANADA	TOTAL
1975	3496049	48855	3544904
1976	3043328	59000	3102328
1977	2544056	259800	2803856
1978	1902733	377732	2280465
1979	2531396	18100	2549496
TOTAL	13517562	763487	14281049

TOTAL VOLUME OF DREDGED MATERIAL (CMPM) 1975-1979

BASIN: ONTARIO

RANK	JURIS	LOCATION	1975 VOLUME	1975 # OF PROJ	1976 VOLUME	1976 # OF PROJ	1977 VOLUME	1977 # OF PROJ	1978 VOLUME	1978 # OF PROJ	1979 VOLUME	1979 # OF PROJ	TOTAL VOLUME	TOTAL # OF PROJ
1	NY	ROCHESTER HARBOR	200539	1	226615	2	103601	1	246502	1	216155	1	993412	6
2	ON	HAMILTON	0	0	127766	1	0	0	146200	2	0	0	273966	3
3	NY	OSWEGO HARBOR	82979	1	30737	1	53803	1	0	0	21398	1	188917	4
4	ON	WHITBY	0	0	0	0	0	0	188300	1	0	0	188300	1
5	ON	OSHAWA	0	0	0	0	10200	1	99500	2	61000	1	170700	4
6	ON	TORONTO HARBOUR	44100	1	0	0	3662	1	13341	1	3392	1	64495	4
7	ON	COBOURG	0	0	33592	1	16000	1	14400	1	0	0	63992	3
8	ON	PORT HOPE	0	0	0	0	0	0	0	0	28000	1	28000	1
9	NY	OGDENSBURG HARBOR	0	0	0	0	26703	1	0	0	0	0	26703	1
10	ON	PORT CREDIT	4700	1	0	0	4600	1	0	0	0	0	9300	2
11	NY	GREAT SODUS BAY HARBOR	8278	1	0	0	0	0	0	0	0	0	8278	1
12	NY	WILSON HARBOR	0	0	0	0	6837	1	0	0	0	0	6837	1
13	ON	POINT TRAVERSE	0	0	4800	1	0	0	0	0	0	0	4800	1
14	ON	LONG POINT (AMHERST ISLAND)	0	0	0	0	0	0	1800	1	0	0	1800	1
15	NY	LITTLE SODUS BAY HARBOR	1612	1	0	0	0	0	0	0	0	0	1612	1

SUMMARY OF DREDGED MATERIAL (CMPM) 1975-1979

YEAR	UNITED STATES	CANADA	TOTAL
1975	293408	48800	342208
1976	257352	166158	423510
1977	190944	34462	225406
1978	246502	463541	710043
1979	237553	92392	329945
TOTAL	1225759	805353	2031112

Appendix 7.2

DREDGED MATERIAL CONTAMINANT LOADS

Does not include loadings estimated from background concentrations (see Chapter 4, Table 5).

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT VOLATILE SOLIDS (%)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPH)	WEIGHTED AVERAGE CONC %	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	9.729	504442.15
2	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	7.548	234357.46
3	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	9.110	147506.17
4	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	11.785	133453.70
5	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	10.757	90984.02
6	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	13.600	77743.75
7	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	4.720	77173.00
8	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	7.333	72979.84
9	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	6.876	63401.57
10	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	4.204	55696.92
11	HURON HARBOR	OH	ERIE	SAND	5	1.50	709850	5.075	54096.97
12	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	5.657	53488.30
13	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	3.113	48289.11
14	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	5.348	41592.57
15	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	4.833	34454.24
16	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	9.900	31710.28
17	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	9.141	31541.88
18	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	18.200	30843.54
19	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	7.461	29692.19
20	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	3.740	26069.52
21	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	6.711	23945.54
22	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	6.250	16345.57
23	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	4.070	15571.82
24	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	2.494	14311.15
25	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	1.716	14188.02
26	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	9.160	12517.91
27	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	8	1.90	412646	1.454	11397.55
28	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	3.956	11317.40
29	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	12.908	11243.25
30	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	6.158	10051.91
31	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	4.462	7546.40
32	WHEATLEY	ON	ERIE	ORGANIC SILT & SAND	1	1.30	59000	9.800	7516.60
33	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	3.194	7352.91
34	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	3.200	6842.88
35	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	7.100	5952.89
36	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	2.648	4824.18

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT VOLATILE SOLIDS (%)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC %	TOTAL LOAD (t)
37	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	8.550	4810.38
38	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	11.989	4717.31
39	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	3.800	4426.37
40	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	3.800	4419.61
41	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	1.707	4336.41
42	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	1.000	3782.46
43	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	4.048	2994.76
44	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	5.624	2696.18
45	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	2.170	2502.25
46	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	2.300	2502.09
47	VERMILION	OH	ERIE	SILT	4	1.66	32696	4.515	2446.20
48	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	1.849	2410.78
49	SEBEWAING	MI	HURON	SAND	1	1.50	14738	10.300	2277.02
50	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	4.300	2064.00
51	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	2.150	1895.01
52	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	1.030	1882.79
53	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	4.200	1783.40
54	SOUTH HAVEN	MI	MICHIGAN	SAND/SILT	2	2.00	96866	0.832	1612.48
55	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	5.781	1594.42
56	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	5.700	1334.56
57	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	2.790	1331.29
58	WHITE LAKE	MI	MICHIGAN	SAND	2	1.90	66573	1.000	1264.89
59	PORT HOPE	ON	ONTARIO	SAND SILT	1	1.60	28000	2.700	1209.60
60	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	3.800	1191.68
61	GRAND BEND	ON	HURON	SAND SILT	2	1.70	25100	2.673	1140.70
62	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	5.780	1017.28
63	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	33.100	1011.54
64	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	2.040	859.60
65	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	2.500	746.63
66	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	1.500	681.84
67	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	1.000	667.44
68	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	3.310	590.08
69	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	4.730	582.10
70	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	3.370	521.95
71	PORT CREDIT	ON	ONTARIO	ORGANIC SILTS	2	1.08	9300	4.855	485.97
72	ST. MARYS RIVER	MI	HURON	SAND/SILT	4	2.00	16576	1.330	440.92

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT VOLATILE SOLIDS (%)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC %	TOTAL LOAD (t)
73	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	0.525	404.88
74	FRANKFORT	MI	MICHIGAN	SAND/SILT	3	1.90	39087	0.518	384.46
75	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	1.580	354.07
76	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	1.200	301.92
77	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	0.609	218.69
78	BAYFIELD	ON	HURON	ORGANIC SILTS AND SAND	1	1.50	25200	0.500	189.00
79	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	0.700	157.92
80	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	1.000	122.94
81	SAUGATUCK	MI	MICHIGAN	SAND	2	2.00	5223	1.000	104.46
82	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	0.470	74.00
83	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	1.100	51.48
84	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	0.250	21.30
85	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.010	16.24
86	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	0.350	12.47

BASIN & COUNTRY SUMMARY FOR VOLATILE SOLIDS

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	83099.63	14489.94	97589.57
MICHIGAN	360501.99	0.00	360501.99
HURON	152884.28	10067.59	162951.87
ERIE	1333076.95	29293.41	1362370.36
ONTARIO	61134.68	48540.49	109675.17
TOTAL	1990697.54	102391.42	2093088.96

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT COD (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	81.590	423019.55
2	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	100.279	311353.17
3	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	175.740	199002.19
4	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	79.296	128389.99
5	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	210.000	120045.49
6	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	68.900	112663.59
7	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	90.485	83431.39
8	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	81.565	81170.50
9	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	91.531	77418.96
10	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	50.385	66752.58
11	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	60.303	62399.76
12	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	192.300	61594.81
13	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	61.953	58573.70
14	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	67.220	52278.16
15	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	137.671	47504.01
16	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	29.895	46375.71
17	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	271.000	45926.37
18	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	104.105	41427.60
19	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	46.358	32312.55
20	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	44.572	31775.65
21	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	76.408	27263.66
22	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	85.800	22437.40
23	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	199.053	17337.43
24	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	27.178	15593.34
25	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	49.182	14068.74
26	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	8	1.90	412646	15.386	12062.74
27	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	81.890	11190.95
28	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	63.382	10346.05
29	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	56.991	9638.32
30	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	150.100	8444.90
31	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	196.600	8284.20
32	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	2	1.65	233100	21.146	8133.02
33	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	33.000	7056.72
34	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	155.442	6115.98
35	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	26.186	6027.68
36	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	29.558	5385.27

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT COD (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
37	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	174.000	4073.91
38	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	15.641	3973.33
39	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	30.600	3564.39
40	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	46.811	3462.75
41	PORT STANLEY	ON	ERIE	MIXED	1	1.60	48855	44.000	3439.39
42	WHEATLEY	ON	ERIE	ORGANIC SILT & SAND	1	1.30	59000	38.000	2914.60
43	SEBEWAING	MI	HURON	SAND	1	1.50	14738	126.300	2792.11
44	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	31.600	2785.22
45	VERMILION	OH	ERIE	SILT	4	1.66	32696	49.413	2677.20
46	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	22.700	2617.56
47	SOUTH HAVEN	MI	MICHIGAN	SAND/SILT	2	2.00	96866	12.421	2406.29
48	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	20.800	2262.76
49	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	44.000	2112.00
50	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	15.300	1779.47
51	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	41.200	1749.43
52	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	71.100	1251.36
53	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	9.435	1229.92
54	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	37.000	1160.32
55	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	22.869	1091.11
56	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	339.500	1037.51
57	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	20.800	945.48
58	GRAND BEND	ON	HURON	SAND SILT	2	1.70	25100	20.432	871.85
59	PORT HOPE	ON	ONTARIO	SAND SILT	1	1.60	28000	19.000	851.20
60	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	27.000	806.36
61	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	9.140	705.52
62	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	55.800	686.71
63	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	43.000	665.99
64	ST. MARYS RIVER	MI	HURON	SAND/SILT	4	2.00	16576	19.600	649.78
65	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	34.100	607.91
66	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	3.192	583.25
67	PORT CREDIT	ON	ONTARIO	ORGANIC SILTS	2	1.08	9300	52.628	526.80
68	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	8.203	393.24
69	BAYFIELD	ON	HURON	ORGANIC SILTS AND SAND	1	1.50	25200	9.300	351.54
70	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	13.500	302.53
71	FRANKFORT	MI	MICHIGAN	SAND/SILT	3	1.90	39087	3.296	244.80
72	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	0.534	202.01

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT COD (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
73	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	7.400	186.18
74	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	3.423	122.97
75	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.700	113.66
76	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	7.300	89.75
77	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	3.129	86.30
78	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	2.300	51.89
79	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	7.100	33.23
80	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	2.000	31.49
81	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	0.410	27.37
82	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	5.400	19.24

BASIN & COUNTRY SUMMARY FOR COD

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	92393.44	8319.20	100712.64
MICHIGAN	450374.81	0.00	450374.81
HURON	134501.34	11065.33	145566.66
ERIE	1492677.35	13336.81	1506014.16
ONTARIO	69466.09	59205.45	128671.54
TOTAL	2239413.02	91926.79	2331339.80

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT O&G (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	5.466	16970.45
2	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	21.400	12233.21
3	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	1.653	8569.75
4	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	3.626	5871.23
5	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	6.335	5358.56
6	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	14.788	5102.66
7	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	3.550	4702.69
8	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	3.234	3662.27
9	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	3.171	2923.75
10	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	48.284	1899.79
11	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	1.464	1384.20
12	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	1.861	1326.53
13	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	4.100	1313.25
14	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	0.707	1096.45
15	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	1.290	1002.98
16	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	10.565	920.24
17	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	0.874	904.80
18	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	0.549	897.75
19	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	2.057	818.71
20	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	3.117	815.22
21	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	0.816	812.38
22	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	8	1.90	412646	0.669	524.75
23	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	0.609	424.55
24	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	2.920	399.04
25	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	0.457	377.85
26	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	4.200	352.14
27	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	0.971	346.53
28	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	0.579	332.27
29	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	1.440	307.93
30	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	1.740	294.88
31	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	0.883	252.59
32	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	1.366	223.05
33	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	4.930	207.74
34	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	2.735	202.35
35	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	1.193	201.82
36	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.937	170.80

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT O&G (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
37	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	0.665	153.15
38	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	1.480	130.45
39	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	0.310	117.26
40	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	0.431	109.61
41	PORT STANLEY	ON	ERIE	MIXED	1	1.60	48855	1.300	101.62
42	SOUTH HAVEN	MI	MICHIGAN	SAND/SILT	2	2.00	96866	0.382	74.05
43	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	0.500	57.66
44	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	0.520	56.57
45	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	0.276	50.41
46	PORT CREDIT	ON	ONTARIO	ORGANIC SILTS	2	1.08	9300	4.723	47.28
47	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	1.940	45.42
48	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	0.337	43.97
49	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	0.900	38.22
50	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	1.100	34.50
51	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	0.294	34.25
52	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	0.284	33.03
53	BAYFIELD	ON	HURON	ORGANIC SILTS AND SAND	1	1.50	25200	0.860	32.51
54	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.180	29.23
55	SEBEWAING	MI	HURON	SAND	1	1.50	14738	1.200	26.53
56	VERMILION	OH	ERIE	SILT	4	1.66	32696	0.483	26.15
57	GRAND BEND	ON	HURON	SAND SILT	2	1.70	25100	0.555	23.68
58	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	0.350	23.36
59	FRANKFORT	MI	MICHIGAN	SAND/SILT	3	1.90	39087	0.282	20.93
60	PORT HOPE	ON	ONTARIO	SAND SILT	1	1.60	28000	0.460	20.61
61	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	1.130	19.89
62	ST. MARYS RIVER	MI	HURON	SAND/SILT	4	2.00	16576	0.558	18.50
63	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	1.120	17.63
64	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	0.357	17.04
65	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	1.100	17.04
66	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	0.250	12.00
67	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	3.700	11.31
68	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	0.290	8.66
69	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	0.375	8.40
70	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	0.143	8.05
71	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	0.626	7.70
72	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	0.056	4.35

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT O&G (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
73	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	0.740	3.46
74	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	0.130	3.27
75	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	0.250	3.07
76	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	0.060	2.73
77	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	0.235	2.00
78	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	0.110	1.96
79	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	0.060	1.35
80	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	0.036	1.29
81	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	0.001	0.00

BASIN & COUNTRY SUMMARY FOR O&G

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	1601.93	381.12	1983.05
MICHIGAN	13876.92	0.00	13876.92
HURON	5975.27	494.57	6469.83
ERIE	59468.22	351.81	59820.03
ONTARIO	1582.12	973.30	2555.42
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TOTAL	82504.46	2200.79	84705.25

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT TKN (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	3.267	16938.54
2	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	2.080	6456.85
3	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	5.535	6267.38
4	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	2.085	3409.89
5	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	3.046	3030.85
6	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	3.295	2787.07
7	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	2.642	2435.86
8	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	1.371	2219.68
9	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	1.625	2152.21
10	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	1.931	1825.27
11	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	3.658	1455.87
12	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	1.279	1323.55
13	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	2.200	1257.62
14	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	0.765	1186.96
15	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	1.374	1068.41
16	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	3.001	1035.35
17	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	1.416	1009.66
18	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	0.929	647.66
19	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	3.500	593.15
20	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	1.886	493.34
21	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	2.673	436.38
22	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	0.737	422.77
23	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	8	1.90	412646	0.531	415.99
24	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	1.130	361.95
25	WHEATLEY	ON	ERIE	ORGANIC SILT & SAND	1	1.30	59000	4.600	352.82
26	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	4.012	349.47
27	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	1.102	315.17
28	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	0.765	272.87
29	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	5.540	217.99
30	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	1.540	210.45
31	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	1.163	196.67
32	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	3.070	172.72
33	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	0.704	162.05
34	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	2	1.65	233100	0.384	147.50
35	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.786	143.22
36	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	1.700	142.53

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT TKN (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
37	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	1.793	132.67
38	SEBEWAING	MI	HURON	SAND	1	1.50	14738	5.800	128.22
39	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	0.954	110.01
40	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	0.500	106.92
41	PORT STANLEY	ON	ERIE	MIXED	1	1.60	48855	1.300	101.62
42	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	0.656	76.41
43	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	0.274	69.59
44	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	0.600	65.27
45	VERMILION	OH	ERIE	SILT	4	1.66	32696	1.187	64.32
46	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	1.440	61.14
47	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	3.050	53.68
48	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	1.090	52.32
49	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	0.520	45.83
50	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	14.600	44.62
51	SOUTH HAVEN	MI	MICHIGAN	SAND/SILT	2	2.00	96866	0.193	37.44
52	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	0.870	36.66
53	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	2.270	35.74
54	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	0.253	32.92
55	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	0.680	32.62
56	GRAND BEND	ON	HURON	SAND SILT	2	1.70	25100	0.639	27.27
57	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	0.538	25.65
58	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	0.800	25.09
59	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.140	22.73
60	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	1.260	19.52
61	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	1.560	19.20
62	PORT CREDIT	ON	ONTARIO	ORGANIC SILTS	2	1.08	9300	1.906	19.08
63	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	0.798	18.68
64	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	0.084	15.28
65	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	0.800	14.26
66	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	0.270	12.27
67	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	0.330	9.86
68	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	0.024	9.08
69	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	0.325	8.96
70	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	0.350	7.84
71	ST. MARYS RIVER	MI	HURON	SAND/SILT	4	2.00	16576	0.190	6.30
72	FRANKFORT	MI	MICHIGAN	SAND/SILT	3	1.90	39087	0.085	6.29

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT TKN (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
73	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	0.140	3.52
74	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	0.260	3.20
75	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	0.373	3.18
76	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	0.035	2.34
77	BAYFIELD	ON	HURON	ORGANIC SILTS AND SAND	1	1.50	25200	0.058	2.19
78	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	0.039	0.88
79	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	0.230	0.82
80	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	0.121	0.57

BASIN & COUNTRY SUMMARY FOR TKN

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	1747.65	151.03	1898.68
MICHIGAN	12692.39	0.00	12692.39
HURON	2465.09	182.21	2647.30
ERIE	42989.58	648.58	43638.16
ONTARIO	1594.54	1016.69	2611.24
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TOTAL	61489.25	1998.51	63487.76

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT NH3(MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	0.276	858.08
2	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	0.513	580.49
3	TOLEDO HARBOR	OH	ERIE	SILT	4	1.46	705296	0.370	380.50
4	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	0.246	245.24
5	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	1.495	243.96
6	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	0.261	240.52
7	FAIRPORT HARBOR	OH	ERIE	SILT	9	1.57	431716	0.232	156.46
8	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	1.695	147.65
9	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	0.131	135.72
10	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	0.390	134.40
11	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	0.077	119.44
12	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	0.067	109.56
13	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	6	1.60	294070	0.093	43.88
14	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	0.050	28.67
15	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	0.093	26.54
16	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.099	18.05
17	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	0.049	15.69
18	ASHTABULA HARBOR	OH	ERIE	SILT/ROCK	3	1.55	115819	0.085	15.26
19	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	0.260	11.04
20	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	0.190	8.01
21	SEBEWAING	MI	HURON	SAND	1	1.50	14738	0.310	6.85
22	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	0.140	6.72
23	VERMILION	OH	ERIE	SILT	4	1.66	32696	0.104	5.65
24	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	0.031	3.57
25	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	0.206	3.24
26	CONNEAUT HARBOR	OH	ERIE	SILT	2	1.60	40223	0.048	3.08
27	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	0.215	1.83
28	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	0.118	1.83
29	ST. CLAIR RIVER	MI	ERIE	SAND	2	1.90	38341	0.010	0.73
30	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	0.022	0.49
31	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	0.007	0.34
32	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	0.009	0.26
33	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	0.020	0.25
34	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	0.012	0.06

BASIN & COUNTRY SUMMARY FOR NH3

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	53.19	0.00	53.19
MICHIGAN	1008.41	0.00	1008.41
HURON	10.43	0.00	10.43
ERIE	2324.90	0.00	2324.90
ONTARIO	157.23	0.00	157.23
TOTAL	3554.15	0.00	3554.15

CONTAMINANT TOTAL P (MG/G)

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	2.019	6267.95
2	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	1.117	5792.76
3	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	1.366	1547.20
4	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	0.886	1434.06
5	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	1.960	1120.42
6	L ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	0.681	1114.32
7	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	0.944	939.80
8	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	0.991	913.83
9	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	0.572	886.84
10	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	2.207	761.58
11	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	0.736	695.85
12	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	1.231	490.02
13	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	0.616	478.72
14	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	0.416	430.12
15	CALUMET HARBOR & RIVER	IL	MICHIGAN	SILT	3	1.43	223860	1.320	422.80
16	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	0.586	417.80
17	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	0.512	356.93
18	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	0.410	338.75
19	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	0.858	328.06
20	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	3.674	320.00
21	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	0.483	276.90
22	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	0.996	260.40
23	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	0.753	215.43
24	WHEATLEY	ON	ERIE	ORGANIC SILT & SAND	1	1.30	59000	2.300	176.41
25	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	8	1.90	412646	0.206	161.61
26	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	0.965	157.48
27	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	0.860	145.74
28	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	0.861	145.65
29	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	1.188	99.61
30	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	0.260	92.66
31	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	0.700	76.15
32	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	0.290	62.01
33	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.300	54.67
34	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	0.560	49.36
35	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	0.980	41.61
36	SOUTH HAVEN	MI	MICHIGAN	SAND/SILT	2	2.00	96866	0.181	35.05

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT TOTAL P (MG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (Mg/g)	TOTAL LOAD (t)
37	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	0.463	34.23
38	GREAT SODUS BAY HARBOR	NY	ONTARIO	SAND	1	1.90	8278	1.970	31.02
39	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	0.630	30.24
40	PORT HOPE	ON	ONTARIO	SAND SILT	1	1.60	28000	0.630	28.22
41	VERMILION	OH	ERIE	SILT	4	1.66	32696	0.484	26.21
42	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	0.101	25.59
43	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	0.060	22.71
44	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	0.160	18.45
45	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	0.348	16.67
46	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	0.216	16.64
47	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	0.088	16.16
48	SEBEWAING	MI	HURON	SAND	1	1.50	14738	0.710	15.70
49	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	0.127	14.77
50	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	0.111	14.47
51	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	0.462	12.74
52	ST. MARYS RIVER	MI	HURON	SAND/SILT	4	2.00	16576	0.320	10.61
53	GRAND BEND	ON	HURON	SAND SILT	2	1.70	25100	0.247	10.56
54	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	0.227	10.32
55	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.050	8.12
56	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	0.170	7.16
57	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	0.273	6.87
58	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	0.220	6.57
59	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	0.423	6.55
60	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	0.310	5.53
61	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	0.119	4.28
62	FRANKFORT	MI	MICHIGAN	SAND/SILT	3	1.90	39087	0.052	3.08
63	PORT CREDIT	ON	ONTARIO	ORGANIC SILTS	2	1.08	9300	0.365	3.65
64	BAYFIELD	ON	HURON	ORGANIC SILTS AND SAND	1	1.50	25200	0.075	2.84
65	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	0.035	2.34
66	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	0.070	2.20
67	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	0.075	1.68
68	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	0.087	1.07
69	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	0.121	0.57
70	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	0.003	0.05
71	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	0.002	0.01

BASIN & COUNTRY SUMMARY FOR TOTAL P

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	656.41	345.61	1002.02
MICHIGAN	3286.17	0.00	3286.17
HURON	1478.79	124.77	1603.55
ERIE	19432.66	563.31	19995.97
ONTARIO	1140.45	499.03	1639.48
TOTAL	25994.47	1532.72	27527.19

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT PCB (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	1.463	4.54
2	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	3.682	4.17
3	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	2.156	3.49
4	ASHTABULA HARBOR	OH	ERIE	SILT/ROCK	3	1.55	115819	3.546	0.64
5	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	7.000	0.29
6	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	MUD	2	1.60	60100	2.384	0.23
7	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	1.267	0.12
8	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	1.000	0.12
9	FAIRPORT HARBOR	OH	ERIE	SILT	6	1.57	314335	0.186	0.09
10	SANDUSKY HARBOR	OH	ERIE	SILT	3	1.36	196752	0.286	0.08
11	ST. CLAIR RIVER	MI	ERIE	SAND	1	1.90	18964	1.000	0.04
12	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	0.180	0.03
13	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	0.468	0.03
14	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.120	0.02
15	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	0.230	0.02
16	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	0.150	0.02
17	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	0.047	0.02
18	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.077	0.01
19	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	0.330	0.01
20	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	1	1.65	75400	0.070	0.01
21	CONNEAUT HARBOR	OH	ERIE	SILT	2	1.60	40229	0.069	0.00

BASIN & COUNTRY SUMMARY FOR PCB

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	0.27	0.01	0.27
MICHIGAN	4.20	0.00	4.20
HURON	3.61	0.00	3.61
ERIE	5.41	0.01	5.42
ONTARIO	0.29	0.17	0.47
TOTAL	13.78	0.19	13.97

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Hg (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	0.360	1.87
2	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	0.905	1.48
3	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	1.087	0.78
4	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	0.679	0.77
5	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	0.190	0.59
6	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	0.302	0.49
7	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	0.555	0.47
8	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	0.869	0.35
9	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	0.409	0.32
10	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	1.200	0.31
11	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	0.299	0.28
12	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	0.344	0.24
13	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	0.233	0.22
14	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	0.856	0.20
15	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	0.100	0.16
16	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	1.000	0.14
17	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	0.142	0.12
18	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	0.114	0.11
19	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	0.300	0.10
20	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	0.100	0.10
21	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	0.500	0.06
22	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	0.134	0.05
23	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.300	0.05
24	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	0.500	0.04
25	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	0.100	0.04
26	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	0.300	0.03
27	CHENAL ECARTE	ON	ERIE	SILTY SAND & CLAY	1	1.65	18100	1.120	0.03
28	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	0.100	0.03
29	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	0.300	0.03
30	KINGSVILLE	ON	ERIE	MIXED	2	1.44	51200	0.358	0.03
31	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	0.150	0.03
32	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	0.100	0.03
33	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	0.250	0.02
34	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	0.500	0.02
35	OSHAWA	ON	ONTARIO	SAND SILT	3	1.60	105700	0.100	0.02
36	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	0.400	0.02

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Hg (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	0.100	0.02
38	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	0.078	0.01
39	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	0.297	0.01
40	COBOURG	ON	ONTARIO	SAND, SILT CLAY	3	1.70	63992	0.120	0.01
41	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	0.100	0.01
42	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	0.100	0.01
43	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	0.200	0.01
44	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	0.100	0.01
45	ST. CLAIR RIVER	MI	ERIE	SAND	2	1.90	38341	0.100	0.01
46	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	0.080	0.01
47	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	0.100	0.01
48	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	0.030	0.01
49	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	0.198	0.01
50	VERMILION	OH	ERIE	SILT	4	1.66	32696	0.100	0.01
51	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	0.100	0.00
52	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	0.100	0.00
53	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	0.230	0.00
54	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	0.100	0.00
55	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	0.100	0.00
56	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	0.100	0.00
57	SEBEWAING	MI	HURON	SAND	1	1.50	14738	0.100	0.00
58	GRAND BEND	ON	HURON	SAND SILT	1	1.70	15100	0.080	0.00
59	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	0.100	0.00
60	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	0.100	0.00
61	RUSCOM RIVER	ON	ERIE	SAND SILT	1	1.60	28410	0.025	0.00
62	PUCE RIVER	ON	ERIE	SAND SILT	1	1.60	11142	0.053	0.00
63	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	0.030	0.00
64	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	0.250	0.00
65	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	0.100	0.00
66	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	0.030	0.00
67	PORT CREDIT	ON	ONTARIO	SAND, CLAY	1	0.95	4600	0.060	0.00
68	GOULAIS RIVER	ON	SUPERIOR	SAND	1	1.70	14800	0.004	0.00
69	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	0.010	0.00

BASIN & COUNTRY SUMMARY FOR Hg

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	0.64	0.12	0.76
MICHIGAN	1.99	0.00	1.99
HURON	0.51	0.02	0.52
ERIE	6.10	0.11	6.21
ONTARIO	0.20	0.08	0.28
TOTAL	9.43	0.32	9.76

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Pb (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	186.506	579.08
2	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	303.580	256.78
3	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	48.597	251.96
4	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	339.000	193.79
5	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	118.842	134.57
6	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	78.049	127.62
7	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	67.079	61.85
8	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	177.629	61.29
9	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	29.520	47.80
10	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	30.778	47.75
11	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	35.714	33.77
12	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	32.986	32.83
13	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	124.172	32.47
14	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	75.933	30.22
15	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	69.384	26.54
16	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	29.541	22.97
17	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	180.000	20.97
18	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	217.341	18.93
19	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	25.053	17.86
20	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	128.000	17.49
21	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	102.004	16.65
22	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	23.737	16.55
23	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	14.761	15.27
24	TORONTO HARBOUR	ON	ONTARIO	SILT, CLAY	4	1.30	64495	175.000	14.67
25	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	24.061	13.80
26	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	73.000	12.37
27	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	8.730	11.57
28	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	30.237	11.44
29	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	38.020	10.88
30	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	111.786	10.65
31	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	46.700	9.99
32	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	19.503	6.96
33	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	25.463	6.47
34	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	55.000	5.37
35	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	6.002	4.96
36	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	35.635	4.65

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Pb (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	19.495	4.49
38	SARNIA	ON	HURON	ORGANICS, SAND, SILT	1	1.30	67800	48.000	4.23
39	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	88.000	3.71
40	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	14.834	2.70
41	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	63.000	2.68
42	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	38.000	2.54
43	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	40.300	2.27
44	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	28.344	2.19
45	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	11.492	2.10
46	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	50.000	1.17
47	VERMILION	OH	ERIE	SILT	4	1.66	32696	21.346	1.16
48	SEBEWAING	MI	HURON	SAND	1	1.50	14738	47.000	1.04
49	PIKE CREEK	ON	ERIE	SAND SILT	1	1.60	19600	31.000	0.97
50	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	60.000	0.93
51	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	7.000	0.81
52	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	7.000	0.81
53	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	18.060	0.71
54	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	13.000	0.62
55	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	24.000	0.54
56	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	30.000	0.53
57	GRAND BEND	ON	HURON	SAND SILT	1	1.70	10000	29.100	0.49
58	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	3.000	0.49
59	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
60	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
61	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	5.670	0.27
62	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	5.836	0.21
63	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	15.600	0.19
64	PORT CREDIT	ON	ONTARIO	SAND, CLAY	1	0.95	4600	39.000	0.17
65	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	10.000	0.12
66	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	12.900	0.11
67	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	4.000	0.09
68	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	17.000	0.08
69	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	20.000	0.06
70	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	0.620	0.00

BASIN & COUNTRY SUMMARY FOR Pb

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	39.52	4.96	44.49
MICHIGAN	536.66	0.00	536.66
HURON	49.73	14.71	64.45
ERIE	1459.78	27.52	1487.30
ONTARIO	62.52	32.58	95.11
TOTAL	2148.22	79.77	2227.99

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT As (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	33.043	102.59
2	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	7.868	40.79
3	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	8.366	12.98
4	HURON HARBOR	OH	ERIE	SAND	5	1.50	709850	10.325	11.01
5	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	10.695	10.64
6	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	8.725	9.88
7	FAIRPORT HARBOR	OH	ERIE	SILT	9	1.57	431716	13.930	9.41
8	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	8.026	7.40
9	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	4.521	7.32
10	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	9.664	6.89
11	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	8.557	5.96
12	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	9.418	5.40
13	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	14.932	5.15
14	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	2.600	4.25
15	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	9.035	3.60
16	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	9.153	2.62
17	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	7.591	1.99
18	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	9	1.60	448500	2.647	1.90
19	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	4.470	0.81
20	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	4.500	0.76
21	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	8.457	0.74
22	VERMILION	OH	ERIE	SILT	4	1.66	32696	12.944	0.70
23	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	3.554	0.65
24	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	3.915	0.64
25	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	0.757	0.63
26	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	1.725	0.62
27	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	12.000	0.51
28	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	5.000	0.48
29	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	1.000	0.38
30	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	1	1.82	62500	2.800	0.32
31	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	7.000	0.29
32	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	2.800	0.27
33	PORT STANLEY	ON	ERIE	MIXED	2	1.61	189000	0.845	0.26
34	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	1.000	0.25
35	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	2.000	0.23
36	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	2.000	0.15

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT As (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	SEBEWAING	MI	HURON	SAND	1	1.50	14738	6.000	0.13
38	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	1.000	0.13
39	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	1.000	0.12
40	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	2.050	0.10
41	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	2.000	0.10
42	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	3.000	0.08
43	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	0.500	0.08
44	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	1.400	0.07
45	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	1.000	0.07
46	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	2.000	0.04
47	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	1.000	0.04
48	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	2.000	0.03
49	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	1.200	0.03
50	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	2.000	0.02
51	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	3.000	0.01

BASIN & COUNTRY SUMMARY FOR As

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	3.43	0.63	4.05
MICHIGAN	17.22	0.00	17.22
HURON	7.71	0.00	7.71
ERIE	213.36	0.26	213.61
ONTARIO	15.89	1.04	16.93
TOTAL	257.61	1.92	259.53

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cd (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	14.468	44.92
2	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	5.802	30.08
3	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	9.489	15.36
4	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	21.763	7.51
5	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	11.400	6.52
6	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	3.700	6.05
7	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	8.007	5.71
8	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	3.612	5.60
9	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	2.795	3.17
10	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	4.304	3.00
11	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	2.667	2.76
12	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	2.986	2.75
13	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	4.000	2.29
14	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	6.596	1.73
15	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	3.968	1.58
16	PORT STANLEY	ON	ERIE	MIXED	2	1.61	189000	5.132	1.56
17	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	4.000	1.43
18	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	1.774	1.38
19	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	3.347	1.27
20	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	1.270	1.26
21	FAIRPORT HARBOR	OH	ERIE	SILT	9	1.57	431716	1.775	1.20
22	MICHIGAN CITY HARBOR	IN	MICHIGAN	SILT	1	1.36	14669	59.000	1.17
23	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	4.561	1.16
24	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	4.298	0.79
25	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	6.514	0.62
26	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
27	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	3.286	0.43
28	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	1.406	0.40
29	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	1	1.82	62500	3.500	0.40
30	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	2.000	0.36
31	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	2.000	0.33
32	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	2.000	0.32
33	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
34	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	0.331	0.27
35	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	3.269	0.25
36	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	2.600	0.17

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cd (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	3.000	0.14
38	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	2.900	0.12
39	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	1.000	0.12
40	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	1.000	0.12
41	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	1.800	0.08
42	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	3.000	0.07
43	VERMILION	OH	ERIE	SILT	4	1.66	32696	1.000	0.05
44	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	1.000	0.05
45	SEBEWAING	MI	HURON	SAND	1	1.50	14738	2.100	0.05
46	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	2.000	0.04
47	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	2.600	0.04
48	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	2.000	0.02
49	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	1.000	0.00

BASIN & COUNTRY SUMMARY FOR Cd

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	4.73	0.27	5.01
MICHIGAN	10.48	0.00	10.48
HURON	15.59	0.00	15.59
ERIE	116.70	1.56	118.26
ONTARIO	6.13	0.00	6.13
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TOTAL	153.63	1.84	155.47

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cu (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	108.749	337.65
2	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	228.016	210.24
3	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	33.980	176.18
4	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	188.000	107.47
5	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	91.459	91.02
6	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	54.000	88.30
7	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	243.737	84.10
8	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	1	1.82	62500	711.000	81.05
9	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	60.056	68.01
10	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	25.328	39.29
11	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	23.045	37.31
12	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	93.536	37.22
13	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	30.404	31.46
14	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	34.471	26.81
15	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	33.910	23.64
16	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	29.372	20.94
17	FAIRPORT HARBOR	OH	ERIE	SILT	9	1.57	431716	27.975	18.91
18	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	32.366	18.57
19	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	19.694	16.28
20	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT		0.90	188300	83.000	14.07
21	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	33.218	12.71
22	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	135.121	10.43
23	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	34.141	9.77
24	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	1118.000	9.53
25	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	99.786	9.51
26	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	27.252	7.13
27	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	31.503	5.14
28	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	11.158	3.98
29	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	45.000	3.77
30	MICHIGAN CITY HARBOR	IN	MICHIGAN	SILT	1	1.36	14669	182.000	3.62
31	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	50.000	2.11
32	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	37.000	1.78
33	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	6.463	1.64
34	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	8.509	1.55
35	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	14.600	1.42
36	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	7.788	1.42

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cu (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	VERMILION	OH	ERIE	SILT	4	1.66	32696	24.402	1.32
38	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	27.000	1.15
39	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	18.643	0.89
40	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	7.000	0.81
41	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	6.800	0.79
42	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	2.000	0.76
43	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	32.000	0.72
44	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	5.000	0.65
45	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	4.000	0.65
46	SEBEWAING	MI	HURON	SAND	1	1.50	14738	26.000	0.57
47	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
48	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	25.000	0.39
49	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
50	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	10.000	0.22
51	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	3.000	0.20
52	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	3.000	0.04
53	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	6.500	0.03

BASIN & COUNTRY SUMMARY FOR Cu

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	135.90	16.28	152.18
MICHIGAN	129.74	0.00	129.74
HURON	39.42	0.00	39.42
ERIE	1219.49	12.71	1232.20
ONTARIO	51.16	19.26	70.43
TOTAL	1575.71	48.26	1623.96

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Zn (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	1045.715	3246.81
2	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	141.503	733.65
3	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	1197.000	684.26
4	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	257.855	417.50
5	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	218.000	356.47
6	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	961.816	331.88
7	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	294.424	271.47
8	MILWAUKEE HARBOR	WI	MICHIGAN	SILT	4	1.50	563884	318.331	269.25
9	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	126.792	196.69
10	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	173.004	195.90
11	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	172.945	172.11
12	MICHIGAN CITY HARBOR	IN	MICHIGAN	SAND SILT	2	1.51	57742	1664.015	144.94
13	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	184.998	128.95
14	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	127.757	120.79
15	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	169.095	120.55
16	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	102.148	105.70
17	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	313.867	82.08
18	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	98.337	76.48
19	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	167.661	66.72
20	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	64.754	53.54
21	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	90.506	51.93
22	PORT STANLEY	ON	ERIE	MIXED	3	1.61	237855	119.125	45.57
23	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	866.000	36.49
24	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	207.000	35.08
25	BUFFALO HARBOR	NY	ERIE	SILT	8	1.41	942924	23.879	31.64
26	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	109.764	31.40
27	KENOSHA HARBOR	WI	MICHIGAN	SILT	2	1.50	91241	186.000	25.42
28	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	251.440	23.95
29	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	230.000	19.28
30	WAUKEGAN HARBOR	IL	MICHIGAN	SAND	2	1.81	64498	140.000	16.31
31	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	98.566	16.09
32	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	2	1.82	126200	60.905	14.02
33	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	124.000	12.10
34	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	25.034	8.93
35	VERMILION	OH	ERIE	SILT	4	1.66	32696	143.814	7.79
36	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	41.133	7.49

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Zn (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	166.000	7.05
38	GODERICH	ON	HURON	SAND, SILT, CLAY	1	1.65	129600	28.700	6.14
39	BOLLES HARBOR	MI	ERIE	SILT/CLAY	1	1.40	40187	107.600	6.05
40	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	29.797	5.44
41	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	17.390	4.42
42	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	31.000	3.57
43	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	74.000	3.55
44	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	26.953	3.51
45	DUNKIRK HARBOR	NY	ERIE	SILT	1	1.65	14233	134.000	3.14
46	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	8.119	3.07
47	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	23.000	2.68
48	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	24.722	1.91
49	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	37.661	1.80
50	SEBEWAING	MI	HURON	SAND	1	1.50	14738	75.000	1.66
51	BLACK ROCK	NY	ERIE	SILT	4	1.28	30685	37.914	1.49
52	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	68.000	1.05
53	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	38.000	0.86
54	CORNUCOPIA HARBOR	WI	SUPERIOR	SAND/MUD	2	1.60	11000	41.000	0.72
55	GRAND BEND	ON	HURON	SAND SILT	1	1.70	10000	42.000	0.71
56	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	10.000	0.67
57	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	17.295	0.62
58	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	72.000	0.61
59	WILSON HARBOR	NY	ONTARIO	SAND	1	1.80	6837	42.700	0.53
60	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	3.000	0.49
61	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
62	PORT CREDIT	ON	ONTARIO	SAND, CLAY	1	0.95	4600	97.000	0.42
63	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	17.000	0.38
64	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
65	KNIFE RIVER HARBOR	MN	SUPERIOR	CLAY/SAND/GRAVEL	1	1.60	1910	54.000	0.17
66	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	13.000	0.16
67	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	13.000	0.06
68	LITTLE SODUS BAY HARBOR	NY	ONTARIO	SAND	1	2.21	1612	4.700	0.02

BASIN & COUNTRY SUMMARY FOR Zn

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	109.49	53.54	163.03
MICHIGAN	782.63	0.00	782.63
HURON	423.59	6.85	430.44
ERIE	6469.24	45.57	6514.82
ONTARIO	265.12	66.89	332.02
TOTAL	8050.08	172.85	8222.94

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cr (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	72.222	374.45
2	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	107.675	334.32
3	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	95.809	155.13
4	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	158.996	146.60
5	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	93.741	106.15
6	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	157.000	89.75
7	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	157.121	62.52
8	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	1	1.38	605657	71.000	59.34
9	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	61.045	57.72
10	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	74.492	53.11
11	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	145.733	50.29
12	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	35.644	36.88
13	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	36.322	36.15
14	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	132.992	34.78
15	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	19.761	30.65
16	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	155.000	26.27
17	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	29.281	22.77
18	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	32.369	22.56
19	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	22.826	13.10
20	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	129.000	12.59
21	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	11.624	9.61
22	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	94.432	9.00
23	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	20.591	7.35
24	MICHIGAN CITY HARBOR	IN	MICHIGAN	SILT	1	1.36	14669	281.000	5.59
25	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	1	1.82	62500	44.000	5.02
26	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	15.281	4.37
27	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	26.439	4.32
28	PORT STANLEY	ON	ERIE	MIXED	1	1.60	48855	51.000	3.99
29	TORONTO HARBOUR	ON	ONTARIO	SILT, CLAY	4	1.30	64495	47.000	3.94
30	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	61.912	2.95
31	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	110.000	2.48
32	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	12.418	2.26
33	VERMILION	OH	ERIE	SILT	4	1.66	32696	32.346	1.75
34	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	37.000	1.57
35	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	37.000	1.56
36	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	29.000	1.39

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cr (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	72.222	374.45
2	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	107.675	334.32
3	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	95.809	155.13
4	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	158.996	146.60
5	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	93.741	106.15
6	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	157.000	89.75
7	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	157.121	62.52
8	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	1	1.38	605657	71.000	59.34
9	FAIRPORT HARBOR	OH	ERIE	SILT	12	1.57	602583	61.045	57.72
10	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	74.492	53.11
11	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	145.733	50.29
12	HURON HARBOR	OH	ERIE	SILT	4	1.50	690030	35.644	36.88
13	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	36.322	36.15
14	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	132.992	34.78
15	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	19.761	30.65
16	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	155.000	26.27
17	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	29.281	22.77
18	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	32.369	22.56
19	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	22.826	13.10
20	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	129.000	12.59
21	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	11.624	9.61
22	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	94.432	9.00
23	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	20.591	7.35
24	MICHIGAN CITY HARBOR	IN	MICHIGAN	SILT	1	1.36	14669	281.000	5.59
25	KEWEENAW WATERWAY	MI	SUPERIOR	MUD	1	1.82	62500	44.000	5.02
26	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	15.281	4.37
27	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	26.439	4.32
28	PORT STANLEY	ON	ERIE	MIXED	1	1.60	48855	51.000	3.99
29	TORONTO HARBOUR	ON	ONTARIO	SILT,CLAY	4	1.30	64495	47.000	3.94
30	BLACK RIVER (UP)	MI	SUPERIOR	SAND	4	1.89	25244	61.912	2.95
31	BLACK RIVER HARBOR	MI	HURON	GRAVEL/SAND	2	1.60	14100	110.000	2.48
32	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	12.418	2.26
33	VERMILION	OH	ERIE	SILT	4	1.66	32696	32.346	1.75
34	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	37.000	1.57
35	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	37.000	1.56
36	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	29.000	1.39

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Cr (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	4.000	1.02
38	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	7.000	0.81
39	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	2.000	0.76
40	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	3.782	0.69
41	SEBEWAING	MI	HURON	SAND	1	1.50	14738	24.000	0.53
42	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	3.000	0.49
43	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
44	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	40.000	0.34
45	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
46	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	2.000	0.26
47	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	3.041	0.23
48	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	14.000	0.22
49	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	2.000	0.13
50	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	4.000	0.09
51	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	3.000	0.04
52	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	4.000	0.02

BASIN & COUNTRY SUMMARY FOR Cr

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	41.32	9.61	50.93
MICHIGAN	192.35	0.00	192.35
HURON	158.95	0.00	158.95
ERIE	1313.04	3.99	1317.03
ONTARIO	36.59	42.80	79.38
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TOTAL	1742.25	56.40	1798.64

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Ni (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
1	SAGINAW	MI	HURON	SAND/SILT/CLAY	7	1.50	1079419	204.230	330.67
2	TOLEDO HARBOR	OH	ERIE	SILT	19	1.44	3590164	42.216	218.88
3	CUYAHOGA RIVER & CLEVELAND HBR	OH	ERIE	SILT	12	1.44	2156377	68.531	212.78
4	CONNEAUT HARBOR	OH	ERIE	SILT	6	1.49	469295	137.226	95.65
5	L. ERIE SAILING C. MICH & OHIO	MI	ERIE	SILT/CLAY	2	1.40	1170582	51.902	84.87
6	ASHTABULA HARBOR	OH	ERIE	SILT	6	1.51	471604	109.513	78.07
7	MONROE	MI	ERIE	SILT/CLAY	5	1.40	658606	76.354	70.40
8	HURON HARBOR	OH	ERIE	SAND	5	1.50	709850	47.205	50.32
9	SANDUSKY HARBOR	OH	ERIE	SILT	6	1.38	722852	42.824	42.62
10	ROUGE RIVER	MI	ERIE	SILT/CLAY	6	1.40	408318	61.000	34.87
11	ROCHESTER HARBOR	NY	ONTARIO	SILT	6	1.56	993412	20.117	31.21
12	LORAIN HARBOR	OH	ERIE	SILT	6	1.42	242973	79.963	27.59
13	GRAND HAVEN	MI	MICHIGAN	SAND/SILT	7	1.80	221079	63.295	25.19
14	GREEN BAY HARBOR	WI	MICHIGAN	SILT	4	1.21	933593	20.693	23.43
15	ERIE HARBOR	PA	ERIE	SILT	4	1.51	379189	37.783	21.68
16	DETROIT RIVER CHANNELS	MI	ERIE	SILT/CLAY	2	1.38	189499	80.010	20.92
17	FAIRPORT HARBOR	OH	ERIE	SILT	9	1.57	431716	30.287	20.47
18	DULUTH-SUPERIOR HARBOR	MN	SUPERIOR	SAND/MUD	10	1.60	486070	25.356	19.72
19	THUNDER BAY	ON	SUPERIOR	MIXED SAND SILT, CLAY	3	1.65	501100	19.650	16.25
20	WHITBY	ON	ONTARIO	ORG. PEAT CLAY, SILT	1	0.90	188300	82.000	13.90
21	ONTONAGON	MI	SUPERIOR	SAND	8	1.55	230503	28.699	10.24
22	OSHAWA	ON	ONTARIO	SILT, CLAY	1	1.60	61000	79.000	7.71
23	MUSKEGON	MI	MICHIGAN	SAND	5	2.10	180117	15.119	5.72
24	MANISTEE	MI	MICHIGAN	SAND/SILT	5	2.00	127015	22.073	5.61
25	ST. JOSEPH	MI	MICHIGAN	SAND/SILT	3	1.90	50136	54.405	5.18
26	MANITOWOC HARBOR	WI	MICHIGAN	SILT	4	1.56	104955	30.948	5.05
27	OSWEGO HARBOR	NY	ONTARIO	SILT	4	1.51	188917	17.377	4.97
28	LUDINGTON	MI	MICHIGAN	SAND	4	2.08	62704	25.953	3.38
29	MICHIGAN CITY HARBOR	IN	MICHIGAN	SILT	1	1.36	14669	142.000	2.83
30	LITTLE LAKE	MI	SUPERIOR	SAND	4	1.95	83141	17.000	2.76
31	ST. CLAIR RIVER	MI	ERIE	SAND	4	1.90	96168	14.019	2.56
32	VERMILION	OH	ERIE	SILT	4	1.66	32696	38.318	2.08
33	HARRISVILLE	MI	HURON	SAND/SILT	2	1.70	67830	17.000	1.96
34	HOLLAND	MI	MICHIGAN	SAND/SILT	4	1.90	95890	9.176	1.67
35	OGDENSBURG HARBOR	NY	ONTARIO	SILT	1	1.58	26703	39.000	1.64
36	TORONTO HARBOUR	ON	ONTARIO	SILT/CLAY	4	1.30	64495	18.000	1.51

DREDGED MATERIAL CONTAMINANT LOADS 1975-1979

CONTAMINANT Ni (UG/G)

RANK	LOCATION	JURIS	BASIN	MATERIAL	NO. OF PROJECTS	WEIGHTED AVERAGE DENSITY (t/CM)	TOTAL QUANTITY (CMPM)	WEIGHTED AVERAGE CONC (ug/g)	TOTAL LOAD (t)
37	TWO HARBORS	MN	SUPERIOR	CLAY/MUD/ROCK	1	2.50	19200	30.000	1.44
38	PENTWATER	MI	MICHIGAN	SAND	3	2.10	31783	18.000	1.20
39	GRAND TRAVERSE	MI	SUPERIOR	SAND	6	1.67	46195	15.146	1.17
40	PORTAGE LAKE	MI	MICHIGAN	SAND	2	1.94	18564	31.637	1.14
41	ROCKY RIVER	OH	ERIE	SILT	1	1.45	29284	25.000	1.06
42	SEBEWAING	MI	HURON	SAND	1	1.50	14738	40.000	0.88
43	LELAND	MI	MICHIGAN	SAND	5	1.80	64686	6.500	0.76
44	BIG BAY	MI	SUPERIOR	SAND	5	1.77	27115	10.000	0.48
45	LAC LABELLE	MI	SUPERIOR	SAND	2	1.80	4723	47.000	0.40
46	PORT WASHINGTON HARBOR	WI	MICHIGAN	SILT	1	1.40	11063	19.000	0.29
47	BIG BAY HARBOR	MI	SUPERIOR	SAND	3	1.77	15600	10.000	0.28
48	CHARLEVOIX	MI	MICHIGAN	SAND	1	2.01	11149	8.000	0.18
49	CHEBOYGAN	MI	MICHIGAN	SAND/SILT/CLAY	1	1.80	6830	8.000	0.10
50	LAPOINT HARBOR	WI	SUPERIOR	SAND	1	1.80	2600	9.000	0.04

BASIN & COUNTRY SUMMARY FOR Ni

BASIN	UNITED STATES	CANADA	TOTAL(t)
SUPERIOR	36.53	16.25	52.77
MICHIGAN	81.73	0.00	81.73
HURON	333.52	0.00	333.52
ERIE	984.82	0.00	984.82
ONTARIO	37.82	23.12	60.94
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TOTAL	1474.41	39.36	1513.77

Appendix 7.3

DISPOSAL OF GREAT LAKES DREDGED MATERIALS

DISPOSAL OF GREAT LAKES DREDGED MATERIALS (CM)

BASIN: SUPERIOR

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	24200	119200	146200	148300	84270	521370	800	522170
CONFINED	82900	0	0	0	3300	0	86200	86200
BEACH	83810	76600	21500	0	0	181910	0	181910
OPEN LAKE	120896	82687	469157	189533	33552	377571	518254	895825
RE-USE	0	0	0	0	0	0	0	0
TOTAL	311806	278487	636857	337833	121122	1080851	605254	1686105

BASIN: MICHIGAN

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	0	0	0	0	0	0	0	0
CONFINED	374351	313450	544481	414107	410105	2056494	0	2056494
BEACH	0	0	0	0	0	0	0	0
OPEN LAKE	289250	381212	297424	271731	217811	1457428	0	1457428
RE-USE	0	0	0	0	0	0	0	0
TOTAL	663601	694662	841905	685838	627916	3513922	0	3513922

BASIN: HURON

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	0	0	0	0	3690	0	3690	3690
CONFINED	35200	0	81239	634868	300974	1009281	43000	1052281
BEACH	0	8900	19938	0	72800	28838	72800	101638
OPEN LAKE	199738	16576	112545	15100	23095	154544	212510	367054
RE-USE	0	0	0	0	0	0	0	0
TOTAL	234938	25476	213722	649968	400559	1192663	332000	1524663

DISPOSAL OF GREAT LAKES DREDGED MATERIALS (CM)

BASIN: ERIE

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	0	0	0	0	0	0	0	0
CONFINED	1492748	1248815	2355625	2026112	2312568	8752704	683164	9435868
BEACH	0	0	20000	0	0	0	20000	20000
OPEN LAKE	2052156	1853513	428231	254353	236928	4764858	60323	4825181
RE-USE	0	0	0	0	0	0	0	0
TOTAL	3544904	3102328	2803856	2280465	2549496	13517562	763487	14281049

BASIN: ONTARIO

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	0	1000	0	65000	0	0	66000	66000
CONFINED	48800	127766	34965	347841	64392	26703	597061	623764
BEACH	1612	0	0	0	0	1612	0	1612
OPEN LAKE	291796	294744	190441	297202	265553	1197444	142292	1339736
RE-USE	0	0	0	0	0	0	0	0
TOTAL	342208	423510	225406	710043	329945	1225759	805353	2031112

BASIN: ALL

DISPOSAL	1975	1976	1977	1978	1979	TOTAL U.S.	TOTAL CANADA	GRAND TOTAL
UPLAND	24200	120200	146200	213300	87960	521370	70490	591860
CONFINED	2033999	1690031	3016310	3422928	3091339	11845182	1409425	13254607
BEACH	85422	85500	61438	0	72800	212360	92800	305160
OPEN LAKE	2953836	2628732	1497798	1027919	776939	7951845	933379	8885224
RE-USE	0	0	0	0	0	0	0	0
TOTAL	5097457	4524463	4721746	4664147	4029038	20530757	2506094	23036851

Appendix 7.4

REGISTER OF GREAT LAKES DREDGING PROJECTS

Does not include loadings estimated from background concentrations (see Chapter 4, Table 5).

LOCATION: GOULAIS RIVER , ON BASIN: SUPERIOR PROJECT BEGAN: 7811 COMPLETE: 7903 ROW= 8

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-+800,LAT 842723W, LONG 464236N, LAND-^14000
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 9413 TOTAL; 14800 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.84 TOTAL $/CMPM; 6.35

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.200	0.400	3.000	301.92	COD (mg/g)	7.400	2.100	13.600	186.18
O&G (mg/g)	0.130	0.080	0.240	3.27	TKN (mg/g)	0.140	0.040	0.260	3.52
TOTAL P (mg/g)	0.273	0.218	0.326	6.87	Hg (ug/g)	0.004	0.001	0.009	0.00

SAMPLING DATES:

202

LOCATION: HURKETT , ON BASIN: SUPERIOR PROJECT BEGAN: 7902 COMPLETE: 7910 ROW= 12

PHYSICAL DATA

MATERIAL: SAND & SILT DISPOSAL METHOD: LAND. 1 KM N.E. OF PUBLIC WHARF
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 3300 TOTAL; 3300 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 16.72 TOTAL $/CMPM; 16.95

REMARKS: EFFORT TO DREDGE FROM ICE FAILED. FLOATING PLANT USED TO COMPLETE WORK

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: THUNDER BAY , ON BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7510 ROW= 10

PHYSICAL DATA

MATERIAL: MIXED SAND SILT CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 63770 TOTAL; 82500 DRY DENSITY(Kg/L): 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.00 TOTAL $/CMPM; 5.39

REMARKS: MISSION R. / DISPOSAL AT ABATIBI BOOMING GROUND. PROJECT BEGAN 7409.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: THUNDER BAY , ON BASIN: SUPERIOR PROJECT BEGAN: 7710 COMPLETE: 7806 ROW= 9

PHYSICAL DATA

MATERIAL: MIXED SAND SILT, CLAY DISPOSAL METHOD: OPEN LAKE- LAT 482412N, LONG 890500W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 121279 TOTAL; 157700 DRY DENSITY(Kg/L): 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.60 TOTAL $/CMPM; 3.77

REMARKS: KEEFER

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.400	0.900	2.400	3642.87	COD (mg/g)	15.000	11.000	21.000	3903.08
O&G (mg/g)	0.220	0.010	0.440	57.25	TKN (mg/g)	0.280	0.240	0.500	72.86
TOTAL P (mg/g)	0.400	0.240	0.500	104.08	Hg (ug/g)	0.060	0.050	0.070	0.02
Pb (ug/g)	11.100	9.400	12.200	2.89	As (ug/g)	1.100	0.800	1.200	0.29
Cd (ug/g)	0.400	0.300	0.400	0.10	Cu (ug/g)	24.800	24.300	25.000	6.45
Zn (ug/g)	57.000	53.000	62.000	14.83	Cr (ug/g)	9.000	6.500	10.300	2.34
Ni (ug/g)	9.900	8.300	10.700	2.58					

OTHER PARAMETERS SE
SAMPLING DATES:

LOCATION: THUNDER BAY , ON BASIN: SUPERIOR PROJECT BEGAN: 7809 COMPLETE: 7811 ROW= 4

PHYSICAL DATA

MATERIAL: MIXED SAND SILT, CLAY DISPOSAL METHOD: OPEN LAKE-LAT 482406N, LONG 890506W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 58000 TOTAL; 75400 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.03 TOTAL $/CMPM; 4.37

REMARKS: KAM R.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.500	2.000	6.500	4354.35	COD (mg/g)	34.000	17.000	80.000	4229.94
O&G (mg/g)	0.160	< 0.020	0.390	< 19.91	TKN (mg/g)	0.600	0.200	1.700	74.65
TOTAL P (mg/g)	0.500	0.360	0.620	62.21	PCB (ug/g)	0.070	0.030	0.100	0.01
Hg (ug/g)	0.110	0.030	0.290	0.01	Pb (ug/g)	8.500	3.400	17.300	1.06
As (ug/g)	0.600	0.400	1.100	0.07	Cd (ug/g)	0.300	0.200	0.600	0.04
Cu (ug/g)	25.700	19.700	32.000	3.20	Zn (ug/g)	41.000	26.000	82.000	5.10
Cr (ug/g)	7.600	5.100	10.000	0.95	Ni (ug/g)	9.300	8.200	11.200	1.16

OTHER PARAMETERS Se
SAMPLING DATES:

LOCATION: THUNDER BAY , ON BASIN: SUPERIOR PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 167

PHYSICAL DATA

MATERIAL: MIXED DISPOSAL METHOD: OPEN LAKE-LAT 4824N, LONG 8906W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 268000 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 3.13

REMARKS: THUNDER BAY TERMINALS. CAPITAL DREDGING PROJECT (NO OTHER INFORMATION)

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.400	5.900	0.500	6190.80	O&G (mg/g)	0.680	< 0.100	13.900	< 300.70
TOTAL P (mg/g)	0.390	0.310	0.540	172.46	PCB (ug/g)	0.000	< 0.001	0.000	< 0.00
Hg (ug/g)	0.200	0.020	1.250	0.09	Pb (ug/g)	2.300	< 1.000	27.000	< 1.02
As (ug/g)	0.600	0.400	1.100	0.27	Cd (ug/g)	0.300	0.200	0.600	0.13
Cu (ug/g)	15.000	7.000	33.000	6.63	Zn (ug/g)	76.000	53.000	98.000	33.61
Cr (ug/g)	14.300	7.000	29.000	6.32	Ni (ug/g)	28.300	16.000	41.000	12.51

OTHER PARAMETERS Co,Se,Fe,ORG.C
SAMPLING DATES: 1976

LOCATION: VIDAL SHOALS , ON BASIN: SUPERIOR PROJECT BEGAN: 7609 COMPLETE: 7611 ROW= 7

PHYSICAL DATA

MATERIAL: ROCK,SAND,CLAY,GRAVL,BOULD DISPOSAL METHOD: OPEN LAKE- LAT 463043N, LONG 842258W
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 3154 TOTAL; 3154 DRY DENSITY(Kg/L); 2.20
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 106.52 TOTAL $/CMPM; 114.61

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

205

LOCATION: BIG BAY HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7509 COMPLETE: 7509 ROW= 203

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 4900 DRY DENSITY(Kg/L); 1.77
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 8.61 TOTAL $/CMPM; 8.61

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.570	3.610	7.530	482.54	COD (mg/g)	3.120	0.940	5.300	27.03
TKN (mg/g)	0.340	0.170	0.500	2.95	NH3 (mg/g)	0.010	0.004	0.017	0.09
TOTAL P (mg/g)	0.480	0.340	0.620	4.16	Hg (ug/g)	0.180	0.000	0.350	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09	As (ug/g)	3.000	0.000	5.000	0.03
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.09					

OTHER PARAMETERS Ba,CN,Fe,Mn
SAMPLING DATES: USDI-220579

LOCATION: BIG BAY HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7607 COMPLETE: 7608 ROW= 171

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 0 TOTAL) 6000 DRY DENSITY(Kg/L)) 1.77
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 6.98 TOTAL $/CMPM) 6.98

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.570	3.610	7.550	590.87	COD (mg/g)	3.120	0.940	5.300	33.10
TKN (mg/g)	0.340	0.170	0.500	3.61	NH3 (mg/g)	0.010	0.004	0.017	0.11
TOTAL P (mg/g)	0.480	0.340	0.620	5.09	Hg (ug/g)	0.180	0.000	0.350	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11	As (ug/g)	3.000	0.000	5.000	0.03
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.11					

OTHER PARAMETERS Ba,CN,Fe,Mn
SAMPLING DATES: USDI-220579

206

LOCATION: BIG BAY HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7707 COMPLETE: 7708 ROW= 221

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 0 TOTAL) 4700 DRY DENSITY(Kg/L)) 1.77
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 6.93 TOTAL $/CMPM) 6.93

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.270	3.610	7.660	521.01	COD (mg/g)	3.150	0.940	5.300	26.18
TKN (mg/g)	0.290	0.170	0.500	2.41	NH3 (mg/g)	0.008	0.004	0.017	0.07
TOTAL P (mg/g)	0.420	0.290	0.620	3.49	Hg (ug/g)	0.240	0.000	0.370	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08	As (ug/g)	3.000	0.000	5.000	0.02
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.08					

OTHER PARAMETERS Ba,CN,Fe,Mn
SAMPLING DATES:

LOCATION: BIG BAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 82

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4651N, LONG 8742W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY: 3564 TOTAL: 3564 DRY DENSITY(Kg/L): 1.77
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.02 TOTAL $/CMPM: 4.02

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.590	3.610	7.660	352.23	COD (mg/g)	8.470	0.890	32.000	53.37
TKN (mg/g)	0.701	0.035	2.600	4.42	NH3 (mg/g)	0.007	0.004	0.017	0.04
TOTAL P (mg/g)	0.344	0.210	0.620	2.17	Hg (ug/g)	0.300	0.000	0.490	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06	As (ug/g)	2.000	0.000	5.000	0.01
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.06					

OTHER PARAMETERS Ba,CN,Fe,Mn,PEST
SAMPLING DATES: COE-220579

LOCATION: BIG BAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 83

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4651N, LONG 8742W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY: 9441 TOTAL: 9441 DRY DENSITY(Kg/L): 1.77
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 5.96 TOTAL $/CMPM: 5.96

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.590	3.610	7.660	933.07	COD (mg/g)	8.470	0.890	32.000	141.38
TKN (mg/g)	0.701	0.035	2.600	11.70	NH3 (mg/g)	0.007	0.004	0.017	0.12
TOTAL P (mg/g)	0.344	0.210	0.620	5.74	Hg (ug/g)	0.300	0.000	0.490	0.01
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17	As (ug/g)	2.000	0.000	5.000	0.03
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.17					

OTHER PARAMETERS Ba,CN,Mn,Fe,PEST
SAMPLING DATES: COE-220579

LOCATION: BIG BAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 84

PHYSICAL DATA

DISPOSAL METHOD: OPEN LAKE-LAT 4651N, LONG 8742W

MATERIAL: SAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 4022 TOTAL; 4022 DRY DENSITY(Kg/L); 1.77
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.09 TOTAL $/CMPM; 7.09

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.590	3.610	7.660	397.50	COD (mg/g)	8.470	0.890	32.000	60.23
TKN (mg/g)	0.701	0.035	2.600	4.98	NH3 (mg/g)	0.007	0.004	0.017	0.05
TOTAL P (mg/g)	0.344	0.210	0.620	2.45	Hg (ug/g)	0.300	0.000	0.490	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07	As (ug/g)	2.000	0.000	5.000	0.01
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.07					

OTHER PARAMETERS Ba,CN,Fe,Mn,PEST
SAMPLING DATES: COE-220579

LOCATION: BIG BAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 85

PHYSICAL DATA

DISPOSAL METHOD: OPEN LAKE-LAT 4651N, LONG 8742W

MATERIAL: SAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 8726 TOTAL; 8726 DRY DENSITY(Kg/L); 1.77
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.15 TOTAL $/CMPM; 3.15

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.590	3.610	7.660	862.40	COD (mg/g)	8.470	0.890	32.000	130.67
TKN (mg/g)	0.701	0.035	2.600	10.81	NH3 (mg/g)	0.007	0.004	0.017	0.11
TOTAL P (mg/g)	0.344	0.210	0.620	5.31	Hg (ug/g)	0.300	0.000	0.490	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15	As (ug/g)	2.000	0.000	5.000	0.03
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.15					

OTHER PARAMETERS Ba,CN,Fe,Mn,PEST
SAMPLING DATES: COE-220579

LOCATION: BIG BAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 86

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4651N, LONG 8742W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY) 1362 TOTAL) 1362 DRY DENSITY(Kg/L)) 1.77
COSTS: CAPITAL CONTAINMENT) 0 , O&M CONTAINMENT) 0 DREDGING $/CMPM) 4.70 TOTAL $/CMPM) 4.70

REMARKS: IN PTS. BTWN 0.13M-N TO 0.30M-N; DATA AVG OVER 0.0M TO 0.3M-N

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.270	3.610	7.660	150.98	COD (mg/g)	3.150	0.940	7.660	7.59
TKN (mg/g)	0.290	0.170	0.500	0.70	NH3 (mg/g)	0.008	0.004	0.017	0.02
TOTAL P (mg/g)	0.417	0.290	0.620	1.00	Hg (ug/g)	0.240	0.000	0.370	0.00
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02	As (ug/g)	3.000	0.000	5.000	0.01
Cd (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02	Cu (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02
Zn (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02	Cr (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02
Ni (ug/g)	< 10.000	< 10.000	< 10.000	< 0.02					

OTHER PARAMETERS Ba,CN,Fe,Mn,PEST
SAMPLING DATES: COE-220579

LOCATION: BLACK RIVER (UP) , MI BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 87

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 464130N, LONG 9003W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 3770 TOTAL) 3770 DRY DENSITY(Kg/L)) 1.89
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.62 TOTAL $/CMPM) 5.62

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.580	0.500	7.900	183.83	COD (mg/g)	20.800	1.500	76.000	148.21
O&G (mg/g)	0.330	0.060	1.000	2.35	TKN (mg/g)	0.487	0.035	1.800	3.47
Hg (ug/g)	< 0.100	< 0.100	< 0.200	< 0.00	Pb (ug/g)	5.500	1.000	2.200	0.04
As (ug/g)	1.400	1.000	2.200	0.01	Cd (ug/g)	< 3.000	< 3.000	< 4.000	< 0.02
Cu (ug/g)	20.000	12.000	32.000	0.14	Zn (ug/g)	38.000	30.000	48.000	0.27
Cr (ug/g)	67.000	21.000	110.000	0.48					

SAMPLING DATES: EPA-270974

LOCATION: BLACK RIVER (UP) , MI BASIN: SUPERIOR PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 88

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 464130N,LONG 9003W
EQUIPMENT TYPE: CLAM
QUANTITY(CMPM): PAY: 7712 TOTAL: 7712 DRY DENSITY(Kg/L): 1.89
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.37 TOTAL $/CMPM: 4.37

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.580	0.500	7.900	376.05	COD (mg/g)	20.800	1.500	76.000	303.17
O&G (mg/g)	0.330	0.060	1.000	4.81	TKN (mg/g)	0.487	0.035	1.800	7.10
Hg (ug/g)	< 0.100	< 0.100	< 0.200	< 0.00	Pb (ug/g)	5.500	1.000	2.200	0.08
As (ug/g)	1.400	1.000	2.200	0.02	Cd (ug/g)	< 3.000	< 3.000	< 4.000	< 0.04
Cu (ug/g)	20.000	12.000	32.000	0.29	Zn (ug/g)	38.000	30.000	48.000	0.55
Cr (ug/g)	67.000	21.000	110.000	0.98					

SAMPLING DATES: EPA-270974

LOCATION: BLACK RIVER (UP) , MI BASIN: SUPERIOR PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 90

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 464130N, LONG 9003W
EQUIPMENT TYPE: HYDRAULIC
QUANTITY(CMPM): PAY: 5199 TOTAL: 5199 DRY DENSITY(Kg/L): 1.89
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 6.10 TOTAL $/CMPM: 6.10

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.580	0.500	7.900	253.51	COD (mg/g)	20.800	1.500	76.000	204.38
O&G (mg/g)	0.330	0.060	1.000	3.24	TKN (mg/g)	0.487	0.350	1.800	4.79
Hg (ug/g)	< 0.100	< 0.100	< 0.200	< 0.00	Pb (ug/g)	5.500	1.000	2.200	0.05
As (ug/g)	1.400	1.000	2.200	0.01	Cd (ug/g)	< 3.000	< 3.000	< 4.000	< 0.03
Cu (ug/g)	20.000	12.000	32.000	0.20	Zn (ug/g)	38.000	30.000	48.000	0.37
Cr (ug/g)	67.000	21.000	110.000	0.66					

SAMPLING DATES: EPA-270974

LOCATION: BLACK RIVER (UP) , MI BASIN: SUPERIOR PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 91

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 464130N, LONG 9003W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 8563 TOTAL; 8563 DRY DENSITY(Kg/L); 1.89
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.62 TOTAL $/CMPM; 2.62

REMARKS: SOUTH BAR AT ENTRANCE 0.06M-W TO 0.31M-E DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.200	0.500	7.900	517.89	COD (mg/g)	26.900	1.500	76.000	435.35
O&G (mg/g)	0.410	0.100	1.000	6.64	TKN (mg/g)	0.636	0.035	1.800	10.29
Hg (ug/g)	< 0.100	< 0.100	< 0.200	< 0.00	Pb (ug/g)	6.000	3.000	11.000	0.10
As (ug/g)	1.400	1.000	2.200	0.02	Cd (ug/g)	< 3.000	< 3.000	< 4.000	< 0.05
Cu (ug/g)	16.000	12.000	20.000	0.26	Zn (ug/g)	37.000	30.000	48.000	0.60
Cr (ug/g)	52.000	21.000	102.000	0.84					

SAMPLING DATES: EPA-270974

LOCATION: GRAND TRAVERSE , MI BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 106

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 471130N, LONG 9003W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 851 TOTAL; 851 DRY DENSITY(Kg/L); 1.67
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.89 TOTAL $/CMPM; 3.89

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.800	0.400	1.200	11.38	COD (mg/g)	7.900	4.200	11.500	11.23
O&G (mg/g)	0.068	0.034	0.101	0.10	TOTAL P (mg/g)	0.210	0.194	0.226	0.30
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.00	Pb (ug/g)	28.000	26.000	29.000	0.04
As (ug/g)	2.000	1.000	2.000	0.00	Cd (ug/g)	3.200	3.000	3.400	0.00
Cu (ug/g)	121.000	79.000	162.000	0.17	Zn (ug/g)	23.000	18.000	28.000	0.03
Cr (ug/g)	2.800	2.000	3.500	0.00	Ni (ug/g)	22.000	21.000	23.000	0.03

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: GRAND TRAVERSE BAY HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7507 COMPLETE: 7509 ROW= 202

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 0 TOTAL) 9010 DRY DENSITY(Kg/L)) 1.67
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 7.92 TOTAL $/CMPM) 7.92

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.000	0.000	0.000	0.02	COD (mg/g)	11.500	11.500	11.500	173.14
O&G (mg/g)	0.034	0.034	0.034	0.51	TOTAL P (mg/g)	0.226	0.226	0.226	3.40
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	29.000	29.000	29.000	0.44
As (ug/g)	2.000	2.000	2.000	0.03	Cd (ug/g)	3.400	3.400	3.400	0.05
Cu (ug/g)	162.000	162.000	162.000	2.44	Zn (ug/g)	28.000	28.000	28.000	0.42
Cr (ug/g)	3.500	2.100	2.100	0.05	Ni (ug/g)	2.100	2.100	2.100	0.03

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: GRAND TRAVERSE , MI BASIN: SUPERIOR PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 107

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 471130N, LONG 881330W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 13862 TOTAL) 13862 DRY DENSITY(Kg/L)) 1.67
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.08 TOTAL $/CMPM) 5.08

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.800	0.400	1.200	185.31	COD (mg/g)	7.900	4.200	11.900	182.99
O&G (mg/g)	0.068	0.034	0.101	1.58	TOTAL P (mg/g)	0.210	0.194	0.226	4.86
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	28.000	26.000	29.000	0.65
As (ug/g)	2.000	1.000	2.000	0.05	Cd (ug/g)	3.200	3.000	3.400	0.07
Cu (ug/g)	121.000	79.000	162.000	2.80	Zn (ug/g)	23.000	18.000	28.000	0.53
Cr (ug/g)	2.800	2.000	3.500	0.06	Ni (ug/g)	22.000	21.000	23.000	0.51

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: GRAND TRAVERSE BAY HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7608 COMPLETE: 7609 ROW= 215

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 6900 DRY DENSITY(Kg/L); 1.67
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.62 TOTAL $/CMPM; 5.62

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.000	0.000	0.000	0.01	COD (mg/g)	11.500	11.500	11.500	132.59
O&G (mg/g)	0.034	0.034	0.034	0.39	TOTAL P (mg/g)	0.226	0.226	0.226	2.61
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	29.000	29.000	29.000	0.33
As (ug/g)	2.000	2.000	2.000	0.02	Cd (ug/g)	3.400	3.400	3.400	0.04
Cu (ug/g)	162.000	162.000	162.000	1.87	Zn (ug/g)	28.000	28.000	28.000	0.32
Cr (ug/g)	3.500	3.500	3.500	0.04	Ni (ug/g)	2.100	2.100	2.100	0.02

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: GRAND TRAVERSE , MI BASIN: SUPERIOR PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 108

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 471130N, LONG 881330W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 12865 TOTAL; 12865 DRY DENSITY(Kg/L); 1.67
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.87 TOTAL $/CMPM; 3.87

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.800	0.400	1.200	171.98	COD (mg/g)	7.900	4.200	11.900	169.83
O&G (mg/g)	0.068	0.034	0.101	1.46	TOTAL P (mg/g)	0.210	0.194	0.226	4.51
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	28.000	26.000	29.000	0.60
As (ug/g)	2.000	1.000	2.000	0.04	Cd (ug/g)	3.200	3.000	3.400	0.07
Cu (ug/g)	121.000	79.000	162.000	2.60	Zn (ug/g)	23.000	18.000	28.000	0.49
Cr (ug/g)	2.800	2.000	3.500	0.06	Ni (ug/g)	22.000	21.000	23.000	0.47

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: GRAND TRAVERSE , MI BASIN: SUPERIOR PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 109

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 471130N, LONG 881330W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY) 2707 TOTAL) 2707 DRY DENSITY(Kg/L)) 1.67
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 19.42 TOTAL $/CMPM) 19.42

REMARKS: W SIDE & NW SIDE-INNER BASIN 0.04M TO 0.08M EAST ENTRANCE DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.800	0.400	1.200	36.19	COD (mg/g)	7.900	4.200	11.900	35.73
O&G (mg/g)	0.068	0.034	0.101	0.31	TOTAL P (mg/g)	0.210	0.194	0.226	0.95
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.00	Pb (ug/g)	28.000	26.000	29.000	0.13
As (ug/g)	2.000	1.000	2.000	0.01	Cd (ug/g)	3.200	3.000	3.400	0.01
Cu (ug/g)	121.000	79.000	162.000	0.55	Zn (ug/g)	23.000	18.000	28.000	0.10
Cr (ug/g)	2.800	2.000	3.500	0.01	Ni (ug/g)	22.000	21.000	23.000	0.10

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-290471

LOCATION: KEWEENAW WATERWAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7508 COMPLETE: 7511 ROW= 199

PHYSICAL DATA

MATERIAL: MUD DISPOSAL METHOD: OPEN LAKE
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY) 0 TOTAL) 62500 DRY DENSITY(Kg/L)) 1.82
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.08 TOTAL $/CMPM) 5.08

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	3.000	4.600	4332.00	COD (mg/g)	33.000	24.000	43.000	3762.00
O&G (mg/g)	0.630	0.320	1.100	71.82	TKN (mg/g)	0.810	0.510	1.100	92.34
Hg (ug/g)	< 0.200	< 0.200	< 0.200	< 0.02	Pb (ug/g)	20.000	8.000	30.000	2.28
As (ug/g)	2.800	2.300	3.100	0.32	Cd (ug/g)	3.500	< 3.000	< 4.000	< 0.40
Cu (ug/g)	711.000	540.000	1100.000	81.05	Zn (ug/g)	71.000	60.000	92.000	8.09
Cr (ug/g)	44.000	33.000	67.000	5.02					

SAMPLING DATES: EPA-260974

LOCATION: KEWEENAW WATERWAY , MI BASIN: SUPERIOR PROJECT BEGAN: 7505 COMPLETE: 7507 ROW= 206

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 63700 DRY DENSITY(Kg/L): 1.82
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.75 TOTAL $/CMPM; 3.75

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.600	0.900	4.300	3020.91	COD (mg/g)	19.500	5.500	35.000	2265.68
O&G (mg/g)	0.700	0.200	1.400	81.33	TKN (mg/g)	0.600	0.300	1.000	69.71
Hg (ug/g)	< 1.500	< 1.000	< 2.000	< 0.17	Pb (ug/g)	19.000	14.000	27.000	2.21
Zn (ug/g)	51.000	27.000	81.000	5.93					

SAMPLING DATES: EPA-130972/260974

LOCATION: LAC LABELLE , MI BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 117

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 472230N, LONG 875530W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 798 TOTAL; 798 DRY DENSITY(Kg/L): 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 16.73 TOTAL $/CMPM; 16.73

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.250	0.200	0.300	3.60	O&G (mg/g)	0.235	0.165	0.305	0.34
TKN (mg/g)	0.373	0.200	0.545	0.54	NH3 (mg/g)	0.215	0.210	0.220	0.31
Pb (ug/g)	12.900	8.800	17.000	0.02	Cu (ug/g)	1118.000	650.000	1585.000	1.61
Zn (ug/g)	72.000	48.000	96.000	0.10	Cr (ug/g)	40.000	34.000	96.000	0.06
Ni (ug/g)	47.000	47.000	47.000	0.07					

OTHER PARAMETERS Al,Fe,Mn
SAMPLING DATES: FWPCA-020969

LOCATION: LAC LABELLE , MI BASIN: SUPERIOR PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 118

PHYSICAL DATA

MATERIAL: SAND
EQUIPMENT TYPE: HYDRAULIC

DISPOSAL METHOD: OPEN LAKE-LAT 472230N, LONG 875530W

QUANTITY(CMPM): PAY; 3925 TOTAL; 3925 DRY DENSITY(Kg/L)) 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.92 TOTAL $/CMPM; 6.92

REMARKS: N. BAR AT ENT., IN PTS BTWN 0.03ME TO 0.25ME DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.250	0.200	0.300	17.70	O&G (mg/g)	0.235	0.165	0.305	1.66
TKN (mg/g)	0.373	0.200	0.545	2.64	NH3 (mg/g)	0.215	0.210	0.220	1.52
Pb (ug/g)	12.900	8.800	17.000	0.09	Cu (ug/g)	1118.000	650.000	1585.000	7.92
Zn (ug/g)	72.000	48.000	96.000	0.51	Cr (ug/g)	40.000	34.000	46.000	0.28
Ni (ug/g)	47.000	47.000	47.000	0.33					

OTHER PARAMETERS Al,Fe,Mn
SAMPLING DATES: FWPCA-020969

LOCATION: LITTLE LAKE , MI BASIN: SUPERIOR PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 124

PHYSICAL DATA

MATERIAL: SAND
EQUIPMENT TYPE: CLAM

DISPOSAL METHOD: OPEN LAKE-LAT 4644N, LONG 852130W

QUANTITY(CMPM): PAY; 28107 TOTAL; 28107 DRY DENSITY(Kg/L)) 1.95
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.15 TOTAL $/CMPM; 7.15

REMARKS: ENTRANCE & HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.010	0.010	0.010	5.49	COD (mg/g)	0.700	0.700	0.700	38.43
O&G (mg/g)	0.180	0.180	0.180	9.88	TKN (mg/g)	0.140	0.140	0.140	7.69
TOTAL P (mg/g)	0.050	0.050	0.050	2.74	PCB (ug/g)	0.120	0.120	0.120	0.01
Hg (ug/g)	0.300	0.100	0.400	0.02	Pb (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16
As (ug/g)	< 0.500	< 0.500	< 0.500	< 0.03	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.11
Cu (ug/g)	4.000	4.000	4.000	0.22	Zn (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16
Cr (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16	Ni (ug/g)	17.000	17.000	17.000	0.93

SAMPLING DATES: EPA-171073

LOCATION: LITTLE LAKE MI BASIN: SUPERIOR PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 127

PHYSICAL DATA

DISPOSAL METHOD: OPEN LAKE-LAT 4644N, LONG 852130W

MATERIAL: SAND
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY) 16995 TOTAL) 16995 DRY DENSITY(Kg/L)) 1.95
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 8.61 TOTAL $/CMPM) 8.61

REMARKS: ENTRANCE & HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.010	0.010	0.010	3.32	COD (mg/g)	0.700	0.700	0.700	23.23
O&G (mg/g)	0.180	0.180	0.180	5.97	TKN (mg/g)	0.140	0.140	0.140	4.65
TOTAL P (mg/g)	0.050	0.050	0.050	1.66	PCB (ug/g)	0.120	0.120	0.120	0.00
Hg (ug/g)	0.300	0.100	0.400	0.01	Pb (ug/g)	< 3.000	< 3.000	< 3.000	< 0.10
As (ug/g)	< 0.500	< 0.500	< 0.500	< 0.02	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.07
Cu (ug/g)	4.000	4.000	4.000	0.13	Zn (ug/g)	< 3.000	< 3.000	< 3.000	< 0.10
Cr (ug/g)	< 3.000	< 3.000	< 3.000	< 0.10	Ni (ug/g)	17.000	17.000	17.000	0.56

SAMPLING DATES: EPA-171073

LOCATION: ONTONAGON MI BASIN: SUPERIOR PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 147

PHYSICAL DATA

DISPOSAL METHOD: OPEN LAKE-LAT 465330N, LONG 8919W

MATERIAL: SAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY) 19813 TOTAL) 19813 DRY DENSITY(Kg/L)) 1.55
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.86 TOTAL $/CMPM) 1.86

REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	2208.28	COD (mg/g)	82.300	2.000	200.000	2524.18
O&G (mg/g)	0.980	0.710	1.600	30.06	TKN (mg/g)	0.820	0.130	1.700	25.15
TOTAL P (mg/g)	0.270	0.140	0.430	8.28	PCB (ug/g)	0.050	< 0.000	0.140	< 0.00
Pb (ug/g)	21.000	< 3.000	42.000	< 0.64	As (ug/g)	1.800	0.800	3.100	0.06
Cd (ug/g)	4.000	< 4.000	4.000	< 0.12	Cu (ug/g)	12.000	< 2.000	23.000	< 0.37
Zn (ug/g)	27.000	3.000	56.000	0.83	Cr (ug/g)	22.000	< 3.000	49.000	< 0.67
Ni (ug/g)	30.000	18.000	37.000	0.92					

SAMPLING DATES: EPA-181073

LOCATION: LITTLE LAKE , MI BASIN: SUPERIOR PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 125

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4644N, LONG 852130W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 9906 TOTAL; 9906 DRY DENSITY(Kg/L): 1.95
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 8.74 TOTAL $/CMPM; 8.74

REMARKS: ENTRANCE & HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.010	0.010	0.010	1.93	COD (mg/g)	0.700	0.700	0.700	13.54
O&G (mg/g)	0.180	0.180	0.180	3.48	TKN (mg/g)	0.140	0.140	0.140	2.71
TOTAL P (mg/g)	0.050	0.050	0.050	0.97	PCB (ug/g)	0.120	0.120	0.120	0.00
Hg (ug/g)	0.300	0.100	0.400	0.01	Pb (ug/g)	< 3.000	< 3.000	< 3.000	< 0.06
As (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.04
Cu (ug/g)	4.000	4.000	4.000	0.08	Zn (ug/g)	< 3.000	< 3.000	< 3.000	< 0.06
Cr (ug/g)	< 3.000	< 3.000	< 3.000	< 0.06	Ni (ug/g)	17.000	17.000	17.000	0.33

SAMPLING DATES: EPA-171073

LOCATION: LITTLE LAKE , MI BASIN: SUPERIOR PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 126

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4644N, LONG 852130W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 28133 TOTAL; 28133 DRY DENSITY(Kg/L): 1.95
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.08 TOTAL $/CMPM; 3.08

REMARKS: ENTRANCE & HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.010	0.010	0.010	5.49	COD (mg/g)	0.700	0.700	0.700	38.46
O&G (mg/g)	0.180	0.180	0.180	9.89	TKN (mg/g)	0.140	0.140	0.140	7.69
TOTAL P (mg/g)	0.050	0.050	0.050	2.75	PCB (ug/g)	0.120	0.120	0.120	0.01
Hg (ug/g)	0.300	0.100	0.400	0.02	Pb (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16
As (ug/g)	< 0.500	< 0.500	< 0.500	< 0.03	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.11
Cu (ug/g)	4.000	4.000	4.000	0.22	Zn (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16
Cr (ug/g)	< 3.000	< 3.000	< 3.000	< 0.16	Ni (ug/g)	17.000	17.000	17.000	0.93

SAMPLING DATES: EPA-171073

LOCATION: ONTONAGON HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7510 COMPLETE: 7511 ROW= 204

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM
QUANTITY(CMPM): PAY; 0 TOTAL; 20940 DRY DENSITY(Kg/L); 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 26221 DREDGING $/CMPM; 4.18 TOTAL $/CMPM; 5.44
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.900	0.300	17.500	2884.95	COD (mg/g)	101.000	2.000	200.000	3273.93
O&G (mg/g)	1.160	0.710	1.600	37.60	TKN (mg/g)	0.920	0.130	1.700	29.82
TOTAL P (mg/g)	0.290	0.140	0.430	9.40	PCB (ug/g)	0.070	< 0.000	0.140	< 0.00
Pb (ug/g)	23.000	< 3.000	42.000	< 0.75	As (ug/g)	2.000	0.800	3.100	0.06
Cd (ug/g)	4.000	< 4.000	4.000	< 0.13	Cu (ug/g)	13.000	< 2.000	23.000	< 0.42
Zn (ug/g)	30.000	3.000	56.000	0.97	Cr (ug/g)	26.000	< 3.000	49.000	< 0.84
Ni (ug/g)	28.000	18.000	37.000	0.91					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON , MI BASIN: SUPERIOR PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 148

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 465330N, LONG 8919W
EQUIPMENT TYPE: DIPPER
QUANTITY(CMPM): PAY; 20411 TOTAL; 20411 DRY DENSITY(Kg/L); 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.71 TOTAL $/CMPM; 4.71
REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	2274.93	COD (mg/g)	82.300	2.000	200.000	2600.37
O&G (mg/g)	0.980	0.710	1.600	30.96	TKN (mg/g)	0.820	0.130	1.700	25.91
TOTAL P (mg/g)	0.270	0.140	0.430	8.53	PCB (ug/g)	0.050	< 0.000	0.140	< 0.00
Pb (ug/g)	21.000	< 3.000	42.000	< 0.66	As (ug/g)	1.800	0.800	3.100	0.06
Cd (ug/g)	4.000	< 4.000	4.000	< 0.13	Cu (ug/g)	12.000	< 2.000	23.000	< 0.38
Zn (ug/g)	27.000	3.000	56.000	0.85	Cr (ug/g)	22.000	< 3.000	49.000	< 0.70
Ni (ug/g)	30.000	18.000	37.000	0.95					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7609 COMPLETE: 7611 ROW= 175

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 67500 DRY DENSITY(Kg/L): 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 40239 DREDGING $/CMPM; 3.31 TOTAL $/CMPM; 3.90
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	7523.28	COD (mg/g)	82.000	2.000	200.000	8568.18
O&G (mg/g)	0.980	0.630	1.600	102.40	TKN (mg/g)	0.820	0.130	1.720	85.68
TOTAL P (mg/g)	0.270	0.140	0.430	28.21	PCB (ug/g)	0.050	0.000	0.140	0.01
Pb (ug/g)	21.000	< 3.000	42.000	< 2.19	As (ug/g)	1.800	0.800	3.100	0.19
Cd (ug/g)	4.000	3.000	4.000	0.42	Cu (ug/g)	12.000	< 2.000	23.000	< 1.25
Zn (ug/g)	27.000	3.000	56.000	2.82	Cr (ug/g)	22.000	< 3.000	49.000	< 2.30
Ni (ug/g)	30.000	18.000	37.000	3.13					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON , MI BASIN: SUPERIOR PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 149

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 465330N, LONG 8919W
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 24829 TOTAL; 24829 DRY DENSITY(Kg/L): 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.14 TOTAL $/CMPM; 3.14
REMARKS: DATA AVG. OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	2767.34	COD (mg/g)	82.300	2.000	200.000	3163.22
O&G (mg/g)	0.980	0.710	1.600	37.67	TKN (mg/g)	0.820	0.130	1.700	31.52
TOTAL P (mg/g)	0.270	0.140	0.430	10.38	PCB (ug/g)	0.050	< 0.000	0.140	< 0.00
Pb (ug/g)	21.000	< 3.000	42.000	< 0.81	As (ug/g)	1.800	0.800	3.100	0.07
Cd (ug/g)	4.000	< 4.000	4.000	< 0.15	Cu (ug/g)	12.000	< 2.000	23.000	< 0.46
Zn (ug/g)	27.000	3.000	56.000	1.04	Cr (ug/g)	22.000	< 3.000	49.000	< 0.85
Ni (ug/g)	30.000	18.000	37.000	1.15					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7707 COMPLETE: 7708 ROW= 218

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 21500 DRY DENSITY(Kg/L); 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.27 TOTAL $/CMPM; 4.27

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	99.85	COD (mg/g)	2.000	2.000	2.000	66.56
O&G (mg/g)	0.710	0.710	0.710	23.63	TKN (mg/g)	0.130	0.130	0.130	4.33
TOTAL P (mg/g)	0.140	0.140	0.140	4.66	PCB (ug/g)	< 0.000	< 0.000	< 0.000	< 0.00
Pb (ug/g)	< 3.000	< 3.000	< 3.000	< 0.10	As (ug/g)	0.800	0.800	0.800	0.03
Cd (ug/g)	4.000	4.000	4.000	0.13	Cu (ug/g)	< 2.000	< 2.000	< 2.000	< 0.07
Zn (ug/g)	3.000	3.000	3.000	0.10	Cr (ug/g)	< 3.000	< 3.000	< 3.000	< 0.10
Ni (ug/g)	18.000	18.000	18.000	0.60					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON , MI BASIN: SUPERIOR PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 150

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 465330N, LONG 8919W
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 45210 TOTAL; 45210 DRY DENSITY(Kg/L); 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.14 TOTAL $/CMPM; 5.14

REMARKS: ENTIRE HARBOR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	5038.93	COD (mg/g)	82.300	2.000	200.000	5759.77
O&G (mg/g)	0.980	0.710	1.600	68.59	TKN (mg/g)	0.820	0.130	1.700	57.39
TOTAL P (mg/g)	0.270	0.140	0.430	18.90	PCB (ug/g)	0.050	< 0.000	0.140	< 0.00
Pb (ug/g)	21.000	< 3.000	42.000	< 1.47	As (ug/g)	1.800	1.800	3.100	0.13
Cd (ug/g)	4.000	< 4.000	4.000	< 0.28	Cu (ug/g)	12.000	< 2.000	23.000	< 0.84
Zn (ug/g)	27.000	3.000	56.000	1.89	Cr (ug/g)	22.000	< 3.000	49.000	< 1.54
Ni (ug/g)	30.000	18.000	37.000	2.10					

SAMPLING DATES: EPA-181073

LOCATION: ONTONAGON HARBOR , MI BASIN: SUPERIOR PROJECT BEGAN: 7709 COMPLETE: 7710 ROW= 222

PHYSICAL DATA

MATERIAL: SAND /DISPOSAL METHOD: LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 10300 DRY DENSITY(Kg/L): 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 10794 DREDGING $/CMPM; 5.94 TOTAL $/CMPM; 6.99

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.200	0.300	17.500	1148.00	COD (mg/g)	82.000	2.000	200.000	1307.44
O&G (mg/g)	0.980	0.630	1.600	15.63	TKN (mg/g)	0.820	0.130	1.720	13.07
TOTAL P (mg/g)	0.270	0.140	0.430	4.30	PCB (ug/g)	0.050	< 0.000	0.140	< 0.00
Pb (ug/g)	21.000	< 3.000	42.000	< 0.33	As (ug/g)	1.800	0.800	3.100	0.03
Cd (ug/g)	4.000	3.000	4.000	0.06	Cu (ug/g)	12.000	< 2.000	23.000	< 0.19
Zn (ug/g)	27.000	3.000	56.000	0.43	Cr (ug/g)	22.000	3.000	56.000	0.35
Ni (ug/g)	30.000	18.000	37.000	0.48					

SAMPLING DATES: EPA-181073

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7505 COMPLETE: 7508 ROW= 198

PHYSICAL DATA

MATERIAL: SAND/MUD DISPOSAL METHOD: OPEN LAKE-+69900, BEACH NOURISHMENT-/29600
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 99500 DRY DENSITY(Kg/L): 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.72 TOTAL $/CMPM; 3.72

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.440	0.700	12.300	8660.48	COD (mg/g)	72.400	5.900	240.000	11526.08
O&G (mg/g)	1.340	< 0.400	2.900	< 213.33	TKN (mg/g)	1.450	0.140	4.700	230.84
NH3 (mg/g)	0.116	0.017	0.380	18.47	TOTAL P (mg/g)	0.706	0.190	2.000	112.40
Hg (ug/g)	0.100	< 0.100	0.500	< 0.02	Pb (ug/g)	23.000	< 5.000	80.000	< 3.66
As (ug/g)	2.000	< 1.000	4.000	< 0.32	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.16
Cu (ug/g)	35.000	4.000	140.000	5.57	Zn (ug/g)	102.000	18.000	275.000	16.24
Cr (ug/g)	29.000	4.000	49.000	4.62	Ni (ug/g)	27.000	< 8.000	65.000	< 4.30

SAMPLING DATES: EPA-1973/1975/1976

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7604 COMPLETE: 7605 ROW= 205

PHYSICAL DATA

MATERIAL: MUD DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 19600 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 24545 DREDGING $/CMPM; 3.91 TOTAL $/CMPM; 5.16

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.610	5.610	5.610	1759.30	COD (mg/g)	81.500	81.500	81.500	2555.84
O&G (mg/g)	0.950	0.950	0.950	29.79	TKN (mg/g)	1.450	1.450	1.450	45.47
NH3 (mg/g)	0.089	0.089	0.089	2.79	TOTAL P (mg/g)	0.475	0.475	0.475	14.90
PCB (ug/g)	1.710	1.710	1.710	0.05	Hg (ug/g)	0.100	0.100	0.100	0.00
Pb (ug/g)	35.000	35.000	35.000	1.10	As (ug/g)	3.500	3.500	3.500	0.11
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.06	Cu (ug/g)	17.500	17.500	17.500	0.55
Zn (ug/g)	71.000	71.000	71.000	2.23	Cr (ug/g)	33.500	33.500	33.500	1.05
Ni (ug/g)	25.000	25.000	25.000	0.78					

OTHER PARAMETERS Mn,Mg,Fe,PEST SCAN
SAMPLING DATES: EPA-120777

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7705 COMPLETE: 7707 ROW= 217

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 58400 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 42972 DREDGING $/CMPM; 6.29 TOTAL $/CMPM; 7.03

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.520	0.700	12.300	5157.89	COD (mg/g)	73.400	5.900	240.000	6858.50
O&G (mg/g)	1.390	< 0.400	2.900	< 129.88	TKN (mg/g)	1.460	0.140	4.700	136.42
NH3 (mg/g)	0.120	0.170	0.380	11.21	TOTAL P (mg/g)	0.690	0.190	2.000	64.47
Hg (ug/g)	0.100	< 0.100	0.500	< 0.01	Pb (ug/g)	24.000	< 5.000	80.000	< 2.24
As (ug/g)	2.000	< 1.000	4.000	< 0.19	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.09
Cu (ug/g)	37.000	4.000	40.000	3.46	Zn (ug/g)	106.000	18.000	175.000	9.90
Cr (ug/g)	30.000	4.000	49.000	2.80	Ni (ug/g)	27.000	< 8.000	65.000	< 2.52

SAMPLING DATES: EPA-1973/1975/1976

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7804 COMPLETE: 7807 ROW= 224

PHYSICAL DATA

MATERIAL: MUD/SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 109000 TOTAL; 109000 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 84800 DREDGING $/CMPM; 3.47 TOTAL $/CMPM; 4.24

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.890	3.150	10.100	12016.16	COD (mg/g)	79.600	24.000	130.000	13882.24
O&G (mg/g)	1.560	< 0.400	3.300	< 272.06	TKN (mg/g)	1.860	0.930	3.100	324.38
TOTAL P (mg/g)	0.760	0.290	1.200	132.54	Hg (ug/g)	1.200	< 0.100	6.000	< 0.21
Pb (ug/g)	41.000	15.000	89.000	7.15	As (ug/g)	3.500	< 1.000	5.100	< 0.61
Cd (ug/g)	2.500	< 1.000	6.000	< 0.44	Cu (ug/g)	59.000	18.000	140.000	10.29
Zn (ug/g)	151.000	71.000	300.000	26.33	Cr (ug/g)	38.000	25.000	49.000	6.63
Ni (ug/g)	33.000	< 4.000	65.000	< 5.76					

SAMPLING DATES: EPA-1973/1975/1976

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7909 COMPLETE: 7911 ROW= 226

PHYSICAL DATA

MATERIAL: MUD DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 40500 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 44024 DREDGING $/CMPM; 9.37 TOTAL $/CMPM; 10.43

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.160	4.700	5.620	3343.68	COD (mg/g)	72.800	64.000	81.500	4717.44
O&G (mg/g)	0.680	0.400	0.900	44.06	TKN (mg/g)	1.230	1.200	1.250	79.70
NH3 (mg/g)	0.083	0.078	0.094	5.38	TOTAL P (mg/g)	0.508	0.475	0.540	32.92
PCB (ug/g)	2.710	< 0.100	5.300	< 0.18	Hg (ug/g)	0.100	< 0.100	0.100	< 0.01
Pb (ug/g)	29.000	23.000	35.000	1.88	As (ug/g)	2.800	< 2.000	3.500	< 0.18
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.13	Cu (ug/g)	14.000	11.000	17.500	0.91
Zn (ug/g)	61.000	50.000	71.000	3.95	Cr (ug/g)	30.000	26.000	33.500	1.94
Ni (ug/g)	23.000	20.000	25.000	1.49					

OTHER PARAMETERS Mn,Mg
SAMPLING DATES: EPA-0777

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7611 COMPLETE: 7611 ROW= 186

PHYSICAL DATA

MATERIAL: SAND/MUD DISPOSAL METHOD: LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 5500 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 11.93 TOTAL $/CMPM; 11.93

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.270	3.150	7.900	463.76	COD (mg/g)	54.200	24.000	89.000	476.96
O&G (mg/g)	0.920	< 0.400	1.500	< 8.10	TKN (mg/g)	1.330	0.930	1.800	11.70
TOTAL P (mg/g)	0.640	0.290	0.870	5.63	Hg (ug/g)	0.200	< 0.100	0.500	< 0.00
Pb (ug/g)	18.000	< 5.000	33.000	< 0.16	As (ug/g)	2.100	< 1.000	3.300	< 0.02
Cd (ug/g)	< 2.000	< 1.000	< 4.000	< 0.02	Cu (ug/g)	49.000	29.500	84.000	0.43
Zn (ug/g)	82.000	80.000	84.000	0.72	Cr (ug/g)	30.000	25.000	35.500	0.26
Ni (ug/g)	21.000	< 8.000	30.000	< 0.18					

SAMPLING DATES: USEPA-73,75,76

225

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7708 COMPLETE: 7711 ROW= 219

PHYSICAL DATA

MATERIAL: SAND/MUD DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 69700 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 49165 DREDGING $/CMPM; 6.65 TOTAL $/CMPM; 7.35

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.240	< 1.000	10.100	< 4728.45	COD (mg/g)	47.900	7.000	130.000	5341.81
O&G (mg/g)	1.230	< 0.250	3.300	< 137.17	TKN (mg/g)	1.147	0.043	3.100	127.91
TOTAL P (mg/g)	0.553	0.210	1.200	61.67	Hg (ug/g)	0.300	< 0.100	0.500	< 0.03
Pb (ug/g)	27.000	< 5.000	89.000	< 3.01	As (ug/g)	2.900	< 2.000	5.100	< 0.32
Cd (ug/g)	3.000	< 1.000	6.000	< 0.33	Cu (ug/g)	31.000	3.000	84.000	3.46
Zn (ug/g)	100.000	8.000	300.000	11.15	Cr (ug/g)	24.000	3.000	49.000	2.68
Ni (ug/g)	16.000	< 8.000	30.000	< 1.78					

SAMPLING DATES: EPA-1973/1976

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7810 COMPLETE: 7812 ROW= 225

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 38500 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 25810 DREDGING $/CMPM; 8.80 TOTAL $/CMPM; 9.47

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	1.600	7.500	2340.80	COD (mg/g)	47.600	< 0.840	95.000	< 2932.16
O&G (mg/g)	1.200	0.400	2.400	73.92	TKN (mg/g)	0.770	0.120	1.530	47.43
NH3 (mg/g)	0.043	< 0.001	0.083	< 2.65	TOTAL P (mg/g)	0.379	0.076	0.680	23.35
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	35.000	< 5.000	75.000	< 2.16
As (ug/g)	2.000	< 1.000	3.000	< 0.12	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.06
Cu (ug/g)	15.000	< 2.000	27.000	< 0.92	Zn (ug/g)	67.000	9.000	145.000	4.13
Cr (ug/g)	16.000	3.000	29.000	0.99	Ni (ug/g)	20.000	< 10.000	30.000	< 1.23

SAMPLING DATES: EPA-0575

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7906 COMPLETE: 7909 ROW= 228

PHYSICAL DATA

MATERIAL: MUD/SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER, CLAM

QUANTITY(CMPM): PAY; 25882 TOTAL; 37570 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.47 TOTAL $/CMPM; 0.00

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.710	1.600	11.600	2831.28	COD (mg/g)	60.100	< 0.840	160.000	< 3612.73
O&G (mg/g)	1.390	0.400	2.900	83.56	TKN (mg/g)	0.920	0.120	2.100	55.30
NH3 (mg/g)	0.058	< 0.001	0.120	< 3.49	TOTAL P (mg/g)	0.430	0.080	0.680	25.85
Hg (ug/g)	0.100	< 0.100	0.200	< 0.01	Pb (ug/g)	24.000	< 5.000	75.000	< 1.44
As (ug/g)	0.000	< 1.000	3.000	< 0.00	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.06
Cu (ug/g)	17.000	< 2.000	30.000	< 1.02	Zn (ug/g)	17.000	9.000	145.000	1.02
Cr (ug/g)	24.000	3.000	36.000	1.44	Ni (ug/g)	24.000	< 10.000	35.000	< 1.44

OTHER PARAMETERS Ba,CN,Mn,Mg,Fe
SAMPLING DATES: EPA-270575/280575

LOCATION: DULUTH-SUPERIOR HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7706 COMPLETE: 7707 ROW= 220

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 7800 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.76 TOTAL $/CMPM; 0.00

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.330	< 1.000	3.390	< 290.78	COD (mg/g)	30.000	10.000	40.000	374.40
O&G (mg/g)	0.890	0.250	1.300	11.11	TKN (mg/g)	0.740	0.040	0.990	9.24
TOTAL P (mg/g)	0.400	0.280	0.530	4.99	Hg (ug/g)	2.100	< 0.100	5.000	< 0.03
Pb (ug/g)	14.000	< 5.000	18.000	< 0.17	As (ug/g)	2.200	< 1.000	3.400	< 0.03
Cd (ug/g)	2.000	< 1.000	3.000	< 0.02	Cu (ug/g)	16.000	8.000	27.000	0.20
Zn (ug/g)	64.000	7.000	95.000	0.80	Cr (ug/g)	29.000	13.000	43.000	0.36
Ni (ug/g)	18.000	< 10.000	28.000	< 0.22					

SAMPLING DATES: EPA-1973/1975/1976

LOCATION: GRAND MARAIS , MN BASIN: SUPERIOR PROJECT BEGAN: 7505 COMPLETE: 7505 ROW= 200

PHYSICAL DATA

MATERIAL: GRAVEL/MUD DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 1350 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 12.08 TOTAL $/CMPM; 12.08

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: KNIFE RIVER HARBOR , MN BASIN: SUPERIOR PROJECT BEGAN: 7506 COMPLETE: 7507 ROW= 201

PHYSICAL DATA

MATERIAL: CLAY/SAND/GRAVEL DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 1910 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 10581 DREDGING $/CMPM; 15.20 TOTAL $/CMPM; 20.74

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	33.100	23.200	43.000	1011.54	COD (mg/g)	339.500	217.100	461.800	1037.51
O&G (mg/g)	3.700	3.300	3.400	11.31	TKN (mg/g)	14.600	10.000	19.200	44.62
TOTAL P (mg/g)	0.002	0.002	0.002	0.01	Hg (ug/g)	0.250	0.200	0.300	0.00
Pb (ug/g)	< 20.000	< 20.000	< 20.000	< 0.06	Zn (ug/g)	54.000	20.000	88.000	0.17

SAMPLING DATES: EPA-140972

LOCATION: TWO HARBORS , MN BASIN: SUPERIOR PROJECT BEGAN: 7607 COMPLETE: 7608 ROW= 207

PHYSICAL DATA

MATERIAL: CLAY/MUD/ROCK DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 0 TOTAL; 19200 DRY DENSITY(Kg/L); 2.50
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 60564 DREDGING $/CMPM; 7.74 TOTAL $/CMPM; 10.90

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.300	2.800	5.800	2064.00	COD (mg/g)	44.000	29.000	59.000	2112.00
O&G (mg/g)	< 0.250	< 0.250	< 0.250	< 12.00	TKN (mg/g)	1.090	0.670	1.500	52.32
NH3 (mg/g)	0.140	0.080	0.200	6.72	TOTAL P (mg/g)	0.630	0.460	0.800	30.24
Hg (ug/g)	0.200	0.200	0.200	0.01	Pb (ug/g)	13.000	< 5.000	20.000	< 0.62
As (ug/g)	2.000	< 2.000	2.000	< 0.10	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.05
Cu (ug/g)	37.000	30.000	43.000	1.78	Zn (ug/g)	74.000	59.000	88.000	3.55
Cr (ug/g)	29.000	27.000	30.000	1.39	Ni (ug/g)	30.000	30.000	30.000	1.44

OTHER PARAMETERS Fe,Mg
SAMPLING DATES: EPA-300676

LOCATION: CORNUCOPIA HARBOR , WI BASIN: SUPERIOR PROJECT BEGAN: 7606 COMPLETE: 7607 ROW= 212

PHYSICAL DATA

MATERIAL: SAND/MUD DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 4800 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 700 DREDGING $/CMPM; 10.41 TOTAL $/CMPM; 10.55

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.780	4.100	8.700	443.90	COD (mg/g)	71.100	49.200	108.100	546.05
O&G (mg/g)	1.130	0.500	1.700	8.68	TKN (mg/g)	3.050	1.500	4.900	23.42
TOTAL P (mg/g)	0.003	< 0.002	0.005	< 0.02	Hg (ug/g)	0.230	< 0.100	0.500	< 0.00
Pb (ug/g)	30.000	< 20.000	42.000	< 0.23	Zn (ug/g)	41.000	24.000	54.000	0.31

SAMPLING DATES: 140972

LOCATION: CORNUCOPIA HARBOR , WI BASIN: SUPERIOR PROJECT BEGAN: 7906 COMPLETE: 7906 ROW= 227

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 3300 TOTAL; 6200 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 5503 DREDGING $/CMPM; 9.80 TOTAL $/CMPM; 11.47

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.780	4.100	8.000	573.38	COD (mg/g)	71.100	49.200	108.100	705.31
O&G (mg/g)	1.130	0.500	1.700	11.21	TKN (mg/g)	3.050	1.500	4.900	30.26
TOTAL P (mg/g)	0.003	< 0.002	0.005	< 0.03	Hg (ug/g)	0.230	< 0.100	0.500	< 0.00
Pb (ug/g)	30.000	< 20.000	42.000	< 0.30	Zn (ug/g)	41.000	24.000	54.000	0.41

SAMPLING DATES: 140972

LOCATION: LAPOINT HARBOR , WI BASIN: SUPERIOR PROJECT BEGAN: 7610 COMPLETE: 7612 ROW= 216

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: ON LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 2600 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 , O&M CONTAINMENT; 740 DREDGING $/CMPM; 22.07 TOTAL $/CMPM; 22.36

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.100	< 1.000	1.380	< 51.48	COD (mg/g)	7.100	2.000	19.000	33.23
O&G (mg/g)	0.740	0.500	0.800	3.46	TKN (mg/g)	0.121	0.026	0.340	0.57
NH3 (mg/g)	0.012	< 0.010	0.018	< 0.06	TOTAL P (mg/g)	0.121	0.039	0.200	0.57
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	17.000	< 10.000	37.000	< 0.08
As (ug/g)	3.000	< 2.000	4.000	< 0.01	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.00
Cu (ug/g)	6.500	2.000	16.000	0.03	Zn (ug/g)	13.000	6.000	32.000	0.06
Cr (ug/g)	4.000	< 2.000	9.400	< 0.02	Ni (ug/g)	9.000	< 8.000	10.000	< 0.04

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-111275

LOCATION: CALUMET HARBOR & RIVER , IL BASIN: MICHIGAN PROJECT BEGAN: 7505 COMPLETE: 7506 ROW= 60

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-122nd & STONEY ISLAND CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 58553 TOTAL; 58553 DRY DENSITY(Kg/L); 1.44
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 30000 DREDGING $/CMPM; 3.68 TOTAL $/CMPM; 4.19

REMARKS: CALUMET R. & ENTRANCE DREDGED,DATA AVG. FROM ENT. TO PENN,NYC BRIDGE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.900	3.500	35.600	8324.13	COD (mg/g)	192.300	51.100	317.000	16168.99
O&G (mg/g)	4.100	1.600	7.500	344.74	TKN (mg/g)	1.130	0.710	1.540	95.01
NH3 (mg/g)	0.049	0.007	0.080	4.12	TOTAL P (mg/g)	1.320	0.860	1.860	110.99

SAMPLING DATES: FWPCA/USDI-0766

LOCATION: CALUMET HARBOR & RIVER , IL BASIN: MICHIGAN PROJECT BEGAN: 7707 COMPLETE: 7712 ROW= 61

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-122nd ST & STONEY ISLAND CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 151298 TOTAL; 151298 DRY DENSITY(Kg/L); 1.43
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 48523 DREDGING $/CMPM; 5.59 TOTAL $/CMPM; 5.91

REMARKS: CALUMET R.,LAKE & ENT. DREDGED, DATA AVG. FROM ENT TO PENN,NYC BRIDGE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.900	3.500	35.600	21404.28	COD (mg/g)	192.300	51.100	317.000	41576.19
O&G (mg/g)	4.100	1.600	7.500	886.44	TKN (mg/g)	1.130	0.710	1.540	244.31
NH3 (mg/g)	0.049	0.007	0.080	10.59	TOTAL P (mg/g)	1.320	0.860	1.860	285.39

SAMPLING DATES: FWPCA/USDI-0766

LOCATION: CALUMET HARBOR & RIVER , IL BASIN: MICHIGAN PROJECT BEGAN: 7801 COMPLETE: 7801 ROW= 62

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-122nd ST & STONEY ISLAND DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 14009 TOTAL; 14009 DRY DENSITY(Kg/L); 1.43
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.60 TOTAL $/CMPM; 7.60

REMARKS: CALUMET R.,LAKE & ENT. DREDGED,DATA AVG FROM ENT TO PENN,NYC BRIDGE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.900	3.500	35.600	1981.87	COD (mg/g)	192.300	51.100	317.000	3849.63
O&G (mg/g)	4.100	1.600	7.500	82.08	TKN (mg/g)	1.130	0.710	1.540	22.62
NH3 (mg/g)	0.049	0.007	0.080	0.98	TOTAL P (mg/g)	1.320	0.860	1.860	26.42

SAMPLING DATES: FWPCA/USDI-0766

LOCATION: WAUKEGAN HARBOR , IL BASIN: MICHIGAN PROJECT BEGAN: 7609 COMPLETE: 7609 ROW= 41

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4221N, LONG 874830W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 26525 TOTAL: 32867 DRY DENSITY(Kg/L): 1.81
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 2.28 TOTAL $/CMPM: 2.28

REMARKS: ENTRANCE CHANNEL DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	3.800	3.800	2255.60	COD (mg/g)	30.600	30.600	30.600	1816.35
O&G (mg/g)	0.294	0.294	0.294	17.45	TKN (mg/g)	0.656	0.656	0.656	38.94
PCB (ug/g)	0.150	0.100	0.200	0.01	Hg (ug/g)	0.300	0.300	0.300	0.02
Pb (ug/g)	180.000	180.000	180.000	10.68	Zn (ug/g)	140.000	140.000	140.000	8.31

SAMPLING DATES: EPA-120473/120576

LOCATION: WAUKEGAN HARBOR , IL BASIN: MICHIGAN PROJECT BEGAN: 7706 COMPLETE: 7707 ROW= 42

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4221N, LONG 874830W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 31631 TOTAL: 31631 DRY DENSITY(Kg/L): 1.81
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 7.23 TOTAL $/CMPM: 7.23

REMARKS: ENTRANCE CHANNEL DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	3.800	3.800	2170.77	COD (mg/g)	30.600	30.600	30.600	1748.04
O&G (mg/g)	0.294	0.294	0.294	16.79	TKN (mg/g)	0.656	0.656	0.656	37.47
PCB (ug/g)	0.150	0.100	0.200	0.01	Hg (ug/g)	0.300	0.300	0.300	0.02
Pb (ug/g)	180.000	180.000	180.000	10.28	Zn (ug/g)	140.000	140.000	140.000	8.00

SAMPLING DATES: EPA-120473/120576

LOCATION: MICHIGAN CITY HARBOR , IN BASIN: MICHIGAN PROJECT BEGAN: 7807 COMPLETE: 7903 ROW= 48

PHYSICAL DATA

MATERIAL: SAND SILT
DISPOSAL METHOD: CONFINED-TRAIL CREEK CONFINED DISPOSAL AREA
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY; 43073 TOTAL; 43073 DRY DENSITY(Kg/L): 1.56
COSTS: CAPITAL CONTAINMENT; 202874 O&M CONTAINMENT; 0 DREDGING $/CMPM; 9.16 TOTAL $/CMPM; 13.87

REMARKS: CONTRACT. OUTER HARBOR & TRAIL CR.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	12.200	0.500	19.900	6197.65	COD (mg/g)	187.100	3.285	309.000	12571.97
O&G (mg/g)	9.930	0.172	15.000	667.24	TKN (mg/g)	3.770	0.068	7.100	253.32
NH3 (mg/g)	1.590	0.190	0.460	106.84	TOTAL P (mg/g)	3.450	0.095	6.300	231.82
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.01	Pb (ug/g)	205.000	11.000	360.000	13.77
As (ug/g)	8.000	5.000	14.000	0.54	Zn (ug/g)	1563.000	17.000	2710.000	105.02

SAMPLING DATES: EPA-170375,USDI-70

LOCATION: MICHIGAN CITY HARBOR , IN BASIN: MICHIGAN PROJECT BEGAN: 7906 COMPLETE: 7907 ROW= 49

PHYSICAL DATA

MATERIAL: SILT
DISPOSAL METHOD: CONFINED- TRAIL CREEK DISPOSAL SITE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 14669 TOTAL; 14669 DRY DENSITY(Kg/L): 1.36
COSTS: CAPITAL CONTAINMENT; 69091 O&M CONTAINMENT; 0 DREDGING $/CMPM; 11.32 TOTAL $/CMPM; 16.03

REMARKS: GOVT. PLANT HIRED LABOR. TRAIL CR.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	15.300	9.400	19.900	3045.59	COD (mg/g)	239.400	129.000	309.000	4765.46
O&G (mg/g)	12.710	7.000	15.000	253.00	TKN (mg/g)	4.830	3.200	7.100	96.15
NH3 (mg/g)	2.050	0.190	0.460	40.81	TOTAL P (mg/g)	4.430	2.100	6.300	88.18
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.00	Pb (ug/g)	259.000	130.000	360.000	5.16
As (ug/g)	10.000	5.000	14.000	0.20	Cd (ug/g)	59.000	22.000	81.000	1.17
Cu (ug/g)	182.000	90.000	220.000	3.62	Zn (ug/g)	2005.000	705.000	2710.000	39.91
Cr (ug/g)	281.000	125.000	370.000	5.59	Ni (ug/g)	142.000	90.000	170.000	2.83

OTHER PARAMETERS Mn,Mg,Fe,Ba
SAMPLING DATES: EPA-170375

LOCATION: ARCADIA , MI BASIN: MICHIGAN PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 77

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4429N, LONG 8616W

EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 9611 TOTAL; 9611 DRY DENSITY(Kg/L)) 1.94

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.72 TOTAL $/CMPM; 7.72

REMARKS: DATA NOT AVAILABLE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA

SAMPLING DATES: 1976

LOCATION: ARCADIA , MI BASIN: MICHIGAN PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 79

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4429N, LONG 8616W

EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 5186 TOTAL; 5186 DRY DENSITY(Kg/L)) 1.94

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.32 TOTAL $/CMPM; 4.32

REMARKS: 0.0M TO 0.14M DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA

SAMPLING DATES: 1977

LOCATION: ARCADIA , MI BASIN: MICHIGAN PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 80

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4429N, LONG 8616W
EQUIPMENT TYPE: HYDRAULIC DREDGE

QUANTITY(CMPM): PAY; 3503 TOTAL; 3503 DRY DENSITY(Kg/L); 1.94
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 14.34 TOTAL $/CMPM; 14.34

REMARKS: 0.03M TO 0.22M DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES: 1978

LOCATION: ARCADIA , MI BASIN: MICHIGAN PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 81

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4429N, LONG 8616W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 4574 TOTAL; 4574 DRY DENSITY(Kg/L); 1.94
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.87 TOTAL $/CMPM; 4.87

REMARKS: 0.0M TO 0.03M,0.04M TO 0.23M DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES: 1979

LOCATION: CHARLEVOIX , MI BASIN: MICHIGAN PROJECT BEGAN: 7507 COMPLETE: 7507 ROW= 93

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4520N, LONG 851630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 11149 TOTAL) 11149 DRY DENSITY(Kg/L) 2.01
COSTS: CAPITAL CONTAINMENT) 0 , O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.45 TOTAL $/CMPM) 2.45

REMARKS: SOUTH BAR INSIDE CHANNEL DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.580	1.450	1.700	354.07	COD (mg/g)	13.500	13.000	14.000	302.53
O&G (mg/g)	0.375	< 0.250	0.500	< 8.40	TKN (mg/g)	0.350	0.350	0.350	7.84
NH3 (mg/g)	0.022	0.010	0.033	0.49	TOTAL P (mg/g)	0.075	0.040	0.110	1.68
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	24.000	21.000	26.000	0.54
As (ug/g)	< 2.000	< 2.000	< 2.000	< 0.04	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.04
Cu (ug/g)	10.000	6.000	13.000	0.22	Zn (ug/g)	17.000	12.000	21.000	0.38
Cr (ug/g)	4.000	3.000	4.000	0.09	Ni (ug/g)	< 8.000	< 8.000	< 8.000	< 0.18

OTHER PARAMETERS Ba,Fe,Mn,Mg.
SAMPLING DATES: EPA-301075

LOCATION: CHEBOYGAN , MI BASIN: MICHIGAN PROJECT BEGAN: 7607 COMPLETE: 7607 ROW= 94

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: OPEN LAKE-LAT 4542N, LONG 842730W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 6830 TOTAL) 6830 DRY DENSITY(Kg/L) 1.80
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.46 TOTAL $/CMPM) 2.46

REMARKS: 0.0M TO 0.25M & 0.85M TO 1.0M DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 122.94	COD (mg/g)	7.300	7.300	7.300	89.75
O&G (mg/g)	< 0.250	< 0.250	< 0.250	< 3.07	TKN (mg/g)	0.260	0.260	0.260	3.20
NH3 (mg/g)	0.020	0.020	0.020	0.25	TOTAL P (mg/g)	0.087	0.087	0.087	1.07
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.12
As (ug/g)	< 2.000	< 2.000	< 2.000	< 0.02	Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.02
Cu (ug/g)	3.000	3.000	3.000	0.04	Zn (ug/g)	13.000	13.000	13.000	0.16
Cr (ug/g)	3.000	3.000	3.000	0.04	Ni (ug/g)	< 8.000	< 8.000	< 8.000	< 0.10

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-291079

LOCATION: FRANKFORT , MI BASIN: MICHIGAN PROJECT BEGAN: 7706 COMPLETE: 7707 ROW= 96

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 443730N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 6869 TOTAL) 6669 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.58 TOTAL $/CMPM) 2.58

REMARKS: NORTH BAR, SOUTH BASIN, SOUTH BAR DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.600	0.400	0.700	78.31	COD (mg/g)	5.350	0.360	9.900	69.82
O&G (mg/g)	0.290	0.270	0.300	3.78	TKN (mg/g)	0.130	0.020	0.200	1.70
TOTAL P (mg/g)	0.063	0.037	0.097	0.82					

SAMPLING DATES: EPA-171072

LOCATION: FRANKFORT , MI BASIN: MICHIGAN PROJECT BEGAN: 7805 COMPLETE: 7805 ROW= 97

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 443730N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 16131 TOTAL) 16131 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.89 TOTAL $/CMPM) 1.89

REMARKS: S. BASIN, N. BAR, 0.02M-E TO 0.07M-E DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.600	0.400	0.700	183.89	COD (mg/g)	5.350	0.360	9.900	163.97
O&G (mg/g)	0.290	0.270	0.300	8.89	TKN (mg/g)	0.130	0.020	0.200	3.98
TOTAL P (mg/g)	0.063	0.037	0.097	1.93					

SAMPLING DATES: EPA-171072

LOCATION: FRANKFORT , MI BASIN: MICHIGAN PROJECT BEGAN: 7907 COMPLETE: 7907 ROW= 98

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 443730N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 16087 TOTAL; 16087 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.48 TOTAL $/CMPM; 1.48

REMARKS: NORTH BAR & SOUTH BAR DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.400	0.400	0.400	122.26	COD (mg/g)	0.360	0.360	0.360	11.00
O&G (mg/g)	0.270	0.270	0.270	8.25	TKN (mg/g)	0.020	0.020	0.020	0.61
TOTAL P (mg/g)	0.037	0.037	0.037	1.13					

SAMPLING DATES: EPA-171072

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7503 COMPLETE: 7504 ROW= 99

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 49656 TOTAL; 49656 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.60 TOTAL $/CMPM; 2.60

REMARKS: N&S BARS, MIDDLE BAR, 0.0M TO 0.90M-E, 0.95M-E TO 2.42M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.880	0.200	13.900	6149.40	COD (mg/g)	98.400	1.100	198.000	8795.07
O&G (mg/g)	1.950	< 0.600	3.800	< 174.29	TKN (mg/g)	3.268	0.005	7.338	292.10
TOTAL P (mg/g)	1.135	0.005	2.396	101.45	Hg (ug/g)	0.950	0.250	1.900	0.08
Pb (ug/g)	71.000	12.000	125.000	6.35	As (ug/g)	10.000	4.000	14.000	0.89
Cd (ug/g)	4.000	1.000	6.000	0.36	Cu (ug/g)	84.000	12.000	181.000	7.51
Zn (ug/g)	166.000	19.000	273.000	14.84	Cr (ug/g)	149.000	9.000	290.000	13.32
Ni (ug/g)	60.000	6.000	116.000	5.36					

OTHER PARAMETERS Ba,CN,Fe,Mg
SAMPLING DATES: EPA-180977

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7604 COMPLETE: 7604 ROW= 100

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 31882 TOTAL; 31882 DRY DENSITY(Kg/L): 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.94 TOTAL $/CMPM; 1.94

REMARKS: N&S BARS,OUTER BAR,NORTH BAR TO 0.76M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.860	0.200	10.600	2215.16	COD (mg/g)	46.500	1.100	144.000	2668.52
O&G (mg/g)	1.340	< 0.600	2.900	< 76.90	TKN (mg/g)	1.584	0.005	5.087	90.90
TOTAL P (mg/g)	0.613	0.005	1.620	35.18	Hg (ug/g)	0.750	0.250	1.350	0.04
Pb (ug/g)	43.000	12.000	120.000	2.47	As (ug/g)	10.000	4.000	14.000	0.57
Cd (ug/g)	3.000	1.000	6.000	0.17	Cu (ug/g)	52.000	11.000	126.000	2.98
Zn (ug/g)	121.000	19.000	235.000	6.94	Cr (ug/g)	89.000	9.000	229.000	5.11
Ni (ug/g)	36.000	6.000	94.000	2.07					

OTHER PARAMETERS Ba,CN,Fe,Mg
SAMPLING DATES: EPA-180977

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7704 COMPLETE: 7704 ROW= 101

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 12437 TOTAL; 12437 DRY DENSITY(Kg/L): 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.01 TOTAL $/CMPM; 7.02

REMARKS: N&S BARS, 1.16M-E TO 2.37M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.900	10.800	13.900	2664.01	COD (mg/g)	167.700	151.000	198.000	3754.23
O&G (mg/g)	2.970	2.400	3.800	66.49	TKN (mg/g)	6.072	5.165	7.338	135.93
TOTAL P (mg/g)	2.006	1.783	2.396	44.91	Hg (ug/g)	1.290	0.620	1.900	0.03
Pb (ug/g)	119.000	111.000	125.000	2.66	As (ug/g)	9.000	7.000	12.000	0.20
Cd (ug/g)	6.000	5.000	6.000	0.13	Cu (ug/g)	139.000	107.000	181.000	3.11
Zn (ug/g)	241.000	223.000	273.000	5.40	Cr (ug/g)	248.000	213.000	290.000	5.55
Ni (ug/g)	100.000	82.000	116.000	2.24					

OTHER PARAMETERS Ba,CN,Fe,Mg
SAMPLING DATES: EPA-180977

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7804 COMPLETE: 7804 ROW= 102

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 39959 TOTAL; 39959 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 , O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.17 TOTAL $/CMPM; 2.17

REMARKS: N.& MID BARS, IN PTS BTWN 1.33M-E TO 2.41M-E DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.300	0.200	13.900	5969.87	COD (mg/g)	117.700	1.100	198.000	8465.71
O&G (mg/g)	2.370	< 0.600	3.800	< 170.47	TKN (mg/g)	4.354	< 0.010	7.338	< 313.17
TOTAL P (mg/g)	1.394	0.004	2.396	100.27	Hg (ug/g)	0.750	0.280	1.350	0.05
Pb (ug/g)	84.000	17.000	125.000	6.04	As (ug/g)	8.000	7.000	10.000	0.58
Cd (ug/g)	4.000	1.000	6.000	0.29	Cu (ug/g)	107.000	12.000	181.000	7.70
Zn (ug/g)	172.000	19.000	273.000	12.37	Cr (ug/g)	171.000	9.000	290.000	12.30
Ni (ug/g)	67.000	6.000	116.000	4.82					

OTHER PARAMETERS Ba,CN,Fe,Mg
SAMPLING DATES: EPA-180977

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7903 COMPLETE: 7904 ROW= 105

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 53221 TOTAL; 53221 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 6725 DREDGING $/CMPM; 3.84 TOTAL $/CMPM; 3.92

REMARKS: N&S BARS,IN PTS BTWN 0.06M-E TO 12.3M-E DRGED,NO DATA UPSTRM OF 3.0M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.960	0.200	13.900	7625.50	COD (mg/g)	110.200	1.100	198.000	10556.92
O&G (mg/g)	1.940	< 0.060	3.800	< 185.85	TKN (mg/g)	3.736	< 0.010	7.338	< 357.90
TOTAL P (mg/g)	1.285	0.004	2.396	123.10	Hg (ug/g)	0.930	0.280	1.900	0.09
Pb (ug/g)	79.000	17.000	125.000	7.57	As (ug/g)	9.000	4.000	13.000	0.86
Cd (ug/g)	4.000	1.000	6.000	0.38	Cu (ug/g)	98.000	12.000	181.000	9.39
Zn (ug/g)	174.000	19.000	273.000	16.67	Cr (ug/g)	165.000	9.000	290.000	15.81
Ni (ug/g)	69.000	6.000	116.000	6.61					

OTHER PARAMETERS Ba,CN,Fe,Mg
SAMPLING DATES: EPA-180977

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7811 COMPLETE: 7811 ROW= 103

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 3449 TOTAL) 3449 DRY DENSITY(Kg/L)) 1.80

COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 6725 DREDGING $/CMPM) 3.84 TOTAL $/CMPM) 3.92

REMARKS: N.& MID BARS, IN PTS BTWN 1.33M-E TO 2.41M-E DREDGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.300	0.200	13.900	515.28	COD (mg/g)	117.700	1.100	198.000	730.71
O&G (mg/g)	2.370	< 0.600	3.800	< 14.71	TKN (mg/g)	4.354	< 0.010	7.338	< 27.03
TOTAL P (mg/g)	1.394	0.004	2.396	8.65	Hg (ug/g)	0.750	0.280	1.350	0.00
Pb (ug/g)	84.000	17.000	125.000	0.52	As (ug/g)	8.000	7.000	10.000	0.05
Cd (ug/g)	4.000	1.000	6.000	0.02	Cu (ug/g)	107.000	12.000	181.000	0.66
Zn (ug/g)	172.000	19.000	273.000	1.07	Cr (ug/g)	171.000	9.000	290.000	1.06
Ni (ug/g)	67.000	6.000	116.000	0.42					

OTHER PARAMETERS Ba,CN,Fe,Mg

SAMPLING DATES: EPA-180979

LOCATION: GRAND HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7812 COMPLETE: 7812 ROW= 104

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4303N, LONG 861530W

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 30475 TOTAL) 30475 DRY DENSITY(Kg/L)) 1.80

COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 6725 DREDGING $/CMPM) 3.84 TOTAL $/CMPM) 3.92

REMARKS: N.& MID BARS, IN PTS BTWN 1.33M-E TO 2.41M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.300	0.200	13.900	4552.97	COD (mg/g)	117.700	1.100	198.000	6456.43
O&G (mg/g)	2.370	< 0.600	3.800	< 130.01	TKN (mg/g)	4.354	< 0.010	7.338	< 238.84
TOTAL P (mg/g)	1.394	0.004	2.396	76.47	Hg (ug/g)	0.750	0.280	1.350	0.04
Pb (ug/g)	84.000	17.000	125.000	4.61	As (ug/g)	8.000	7.000	10.000	0.44
Cd (ug/g)	4.000	1.000	6.000	0.22	Cu (ug/g)	107.000	12.000	181.000	5.87
Zn (ug/g)	172.000	19.000	273.000	9.44	Cr (ug/g)	171.000	9.000	290.000	9.38
Ni (ug/g)	67.000	6.000	116.000	3.68					

OTHER PARAMETERS Ba,CN,Fe,Mg

SAMPLING DATES: EPA-180977

LOCATION: HOLLAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7604 COMPLETE: 7604 ROW= 113

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 424530N, LONG 8614W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 23114 TOTAL: 23114 DRY DENSITY(Kg/L): 1.90
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 344 DREDGING $/CMPM: 1.71 TOTAL $/CMPM: 1.72

REMARKS: N & S BARS, N & S BASINS, 0.16M-W TO 0.57M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.200	< 1.000	5.800	< 966.17	COD (mg/g)	21.700	2.900	77.000	952.99
O&G (mg/g)	0.850	< 0.600	1.200	< 37.33	TKN (mg/g)	0.637	< 0.010	2.500	< 27.97
NH3 (mg/g)	0.022	< 0.010	0.057	< 0.97	TOTAL P (mg/g)	0.211	< 0.010	0.720	< 9.27
PCB (ug/g)	0.080	< 0.010	0.300	< 0.00	Hg (ug/g)	0.100	< 0.100	0.200	< 0.00
Pb (ug/g)	14.000	< 2.000	51.000	< 0.61	As (ug/g)	4.000	< 2.000	10.000	< 0.18
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.09	Cu (ug/g)	8.000	1.000	29.000	0.35
Zn (ug/g)	39.000	10.000	120.000	1.71	Cr (ug/g)	13.000	3.000	36.000	0.57
Ni (ug/g)	8.000	1.000	23.000	0.35					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-180977

LOCATION: HOLLAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7704 COMPLETE: 7704 ROW= 114

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 424530N, LONG 8614W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 18043 TOTAL: 18043 DRY DENSITY(Kg/L): 1.90
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 6925 DREDGING $/CMPM: 2.77 TOTAL $/CMPM: 3.15

REMARKS: N BAR, 1.16M-W TO 0.00M

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 342.82	COD (mg/g)	3.000	2.900	3.000	102.85
O&G (mg/g)	0.900	< 0.600	1.200	< 30.85	TKN (mg/g)	0.013	0.010	0.015	0.45
NH3 (mg/g)	< 0.010	< 0.010	< 0.010	< 0.34	TOTAL P (mg/g)	0.057	0.046	0.068	1.95
PCB (ug/g)	< 0.010	< 0.010	< 0.010	< 0.00	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	< 2.000	< 2.000	< 2.000	< 0.07	As (ug/g)	2.000	< 2.000	2.000	< 0.07
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.07	Cu (ug/g)	2.000	1.000	2.000	0.07
Zn (ug/g)	12.000	11.000	13.000	0.41	Cr (ug/g)	6.000	3.000	8.000	0.21
Ni (ug/g)	3.000	1.000	5.000	0.10					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-180977

LOCATION: HOLLAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7804 COMPLETE: 7804 ROW= 115

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 424530N, LONG 8614W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 31775 TOTAL; 31775 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 1443 DREDGING $/CMPM; 3.00 TOTAL $/CMPM; 3.05

REMARKS: N&S & MID BARS, IN PTS BTWN 0:16M-W TO 5.73M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.100	< 1.000	11.000	< 3079.00	COD (mg/g)	69.400	2.900	180.000	4189.85
O&G (mg/g)	1.100	< 0.600	1.600	< 66.41	TKN (mg/g)	1.890	0.010	4.700	114.10
NH3 (mg/g)	0.270	< 0.010	0.590	< 16.30	TOTAL P (mg/g)	0.690	< 0.010	1.700	< 41.66
PCB (ug/g)	0.160	< 0.010	0.310	< 0.01	Hg (ug/g)	0.100	< 0.100	0.200	< 0.01
Pb (ug/g)	32.000	2.000	71.000	1.93	As (ug/g)	8.000	2.000	22.000	0.48
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.12	Cu (ug/g)	18.000	1.000	40.000	1.09
Zn (ug/g)	81.000	10.000	170.000	4.89	Cr (ug/g)	21.000	3.000	40.000	1.27
Ni (ug/g)	18.000	1.000	44.000	1.09					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-180977

LOCATION: HOLLAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7904 COMPLETE: 7904 ROW= 116

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 424530N, LONG 8614W +20020,CONFINED-*2938
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 22958 TOTAL; 22958 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 18371 DREDGING $/CMPM; 3.22 TOTAL $/CMPM; 16.10

REMARKS: N&S BARS, CENTER BAR, 0.02M-W TO 0.28M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 436.20	COD (mg/g)	3.200	2.900	3.700	139.58
O&G (mg/g)	0.830	< 0.600	120.000	< 36.20	TKN (mg/g)	0.016	0.010	0.023	0.70
NH3 (mg/g)	< 0.010	< 0.010	0.010	< 0.44	TOTAL P (mg/g)	0.041	< 0.010	0.068	< 1.79
PCB (ug/g)	0.010	< 0.010	0.010	< 0.00	Hg (ug/g)	0.010	< 0.010	0.010	< 0.00
Pb (ug/g)	< 2.000	< 2.000	< 2.000	< 0.09	As (ug/g)	2.000	< 2.000	2.000	< 0.09
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.09	Cu (ug/g)	1.000	1.000	2.000	0.04
Zn (ug/g)	11.000	10.000	13.000	0.48	Cr (ug/g)	5.000	3.000	8.000	0.22
Ni (ug/g)	3.000	1.000	5.000	0.13					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-180977

LOCATION: LELAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7500 COMPLETE: 7500 ROW= 119

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4501N, LONG 854730W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 5319 TOTAL; 5319 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.89 TOTAL $/CMPM; 5.89

REMARKS: APPROACH CHANNEL DRGED, DATA AVG AT UPSTM LIM&NW PT OF ANCHORAGE AREA

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	2.200	5.400	363.42	COD (mg/g)	15.300	4.400	26.100	146.32
O&G (mg/g)	0.284	0.225	0.342	2.72	TOTAL P (mg/g)	0.127	0.043	0.211	1.21
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.00	Pb (ug/g)	7.000	2.000	11.000	0.07
As (ug/g)	1.000	1.000	1.000	0.01	Cd (ug/g)	1.000	0.900	1.100	0.01
Cu (ug/g)	6.800	2.500	11.000	0.07	Zn (ug/g)	23.000	14.000	32.000	0.22
Ni (ug/g)	6.500	3.800	9.200	0.06					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: LELAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 120

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4501N, LONG 854730W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 20105 TOTAL; 20105 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.69 TOTAL $/CMPM; 3.69

REMARKS: APP.CH, ANCHORAGE, CARP R.DRGED.DATA FROM UP LIM&NW PT OF ANCHORAGE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	2.200	5.400	1373.65	COD (mg/g)	15.300	4.400	26.100	553.08
O&G (mg/g)	0.284	0.225	0.342	10.27	TOTAL P (mg/g)	0.127	0.043	0.211	4.59
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.02	Pb (ug/g)	7.000	2.000	11.000	0.25
As (ug/g)	1.000	1.000	1.000	0.04	Cd (ug/g)	1.000	0.900	1.100	0.04
Cu (ug/g)	6.800	2.500	11.000	0.25	Zn (ug/g)	23.000	14.000	32.000	0.83
Ni (ug/g)	6.500	3.800	9.200	0.23					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: LELAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 121

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4501N, LONG 854730W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 15624 TOTAL; 15624 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.61 TOTAL $/CMPM; 3.61

REMARKS: APP.CH,ANCHORAGE DRGED,DATA FROM UPSTM LIM&NW PT OF ANCHORAGE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	2.200	5.400	1067.49	COD (mg/g)	15.300	4.400	26.100	429.81
O&G (mg/g)	0.284	0.225	0.342	7.98	TOTAL P (mg/g)	0.127	0.043	0.211	3.57
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	7.000	2.000	11.000	0.20
As (ug/g)	1.000	1.000	1.000	0.03	Cd (ug/g)	1.000	0.900	1.100	0.03
Cu (ug/g)	6.800	2.500	11.000	0.19	Zn (ug/g)	23.000	14.000	32.000	0.65
Ni (ug/g)	6.500	3.800	9.200	0.18					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: LELAND MI BASIN: MICHIGAN PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 122

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4501N, LONG 854730W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 10386 TOTAL; 10386 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.17 TOTAL $/CMPM; 6.17

REMARKS: ANCHORAGE DRGED,DATA FROM UPSTM LIM&NW PT OF ANCHOR AREA

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	2.200	5.400	709.61	COD (mg/g)	15.300	4.400	26.100	285.71
O&G (mg/g)	0.284	0.225	0.342	5.30	TOTAL P (mg/g)	0.127	0.043	0.211	2.37
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	7.000	2.000	11.000	0.13
As (ug/g)	1.000	1.000	1.000	0.02	Cd (ug/g)	1.000	0.900	1.100	0.02
Cu (ug/g)	6.800	2.500	11.000	0.13	Zn (ug/g)	23.000	14.000	32.000	0.43
Ni (ug/g)	6.500	3.800	9.200	0.12					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: LELAND , MI BASIN: MICHIGAN PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 123

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4501N, LONG 854730W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 13252 TOTAL; 13252 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.77 TOTAL $/CMPM; 4.77

REMARKS: APP.CH.,ANCHORAGE,CARP R.DRGED,DATA FROM UP LIMIT&NW PT OF ANCHOR AREA

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	2.200	5.400	905.43	COD (mg/g)	15.300	4.400	26.100	364.55
O&G (mg/g)	0.284	0.225	0.342	6.77	TOTAL P (mg/g)	0.127	0.043	0.211	3.03
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	7.000	2.000	11.000	0.17
As (ug/g)	1.000	1.000	1.000	0.02	Cd (ug/g)	1.000	0.900	1.100	0.02
Cu (ug/g)	6.800	2.500	11.000	0.16	Zn (ug/g)	23.000	14.000	32.000	0.55
Ni (ug/g)	6.500	3.800	9.200	0.15					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: LUDINGTON , MI BASIN: MICHIGAN PROJECT BEGAN: 7504 COMPLETE: 7504 ROW= 128

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 435630N, LONG 8630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 8972 TOTAL; 8972 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.86 TOTAL $/CMPM; 1.86

REMARKS: N & S BARS, N & S BASINS,0.06M-E TO 0.27M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.770	< 1.000	3.860	< 333.49	COD (mg/g)	8.800	1.000	29.000	165.80
O&G (mg/g)	0.350	< 0.200	0.470	< 6.59	TKN (mg/g)	0.230	0.018	0.710	4.33
TOTAL P (mg/g)	0.105	0.048	0.270	1.98	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	35.000	17.000	62.000	0.66	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.02
Cd (ug/g)	3.000	0.300	4.900	0.06	Cu (ug/g)	5.000	3.000	9.000	0.09
Zn (ug/g)	26.000	11.000	65.000	0.49	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.04
Ni (ug/g)	25.000	14.000	43.000	0.47					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-180674

LOCATION: LUDINGTON , MI BASIN: MICHIGAN PROJECT BEGAN: 7605 COMPLETE: 7605 ROW= 130

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 435630N, LONG 8630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 6171 TOTAL; 6171 DRY DENSITY(Kg/L) 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.07 TOTAL $/CMPM; 3.07

REMARKS: N & S BARS, N & S BASINS,0.08M-W TO 0.15M-W

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.770	< 1.000	3.860	< 229.38	COD (mg/g)	8.800	1.000	29.000	114.04
O&G (mg/g)	0.350	< 0.200	0.470	< 4.54	TKN (mg/g)	0.230	0.018	0.710	2.98
TOTAL P (mg/g)	0.105	0.048	0.270	1.36	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	35.000	17.000	62.000	0.45	As (ug/g)	1.000	< 1.000	< 1.000	< 0.01
Cd (ug/g)	3.000	0.300	4.900	0.04	Cu (ug/g)	5.000	3.000	9.000	0.06
Zn (ug/g)	26.000	11.000	65.000	0.34	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.03
Ni (ug/g)	25.000	14.000	43.000	0.32					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-180674

LOCATION: LUDINGTON , MI BASIN: MICHIGAN PROJECT BEGAN: 7706 COMPLETE: 7706 ROW= 131

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 435630N, LONG 8630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 20339 TOTAL; 20339 DRY DENSITY(Kg/L) 2.04
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.75 TOTAL $/CMPM; 2.75

REMARKS: NORTH BAR, MIDDLE BAR, NORTH AND BASINS

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.020	< 1.000	3.860	< 836.08	COD (mg/g)	10.800	1.000	29.000	447.01
O&G (mg/g)	0.310	< 0.200	0.410	< 12.83	TKN (mg/g)	0.301	0.073	0.710	12.46
TOTAL P (mg/g)	0.124	0.048	0.270	5.13	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	37.000	17.000	62.000	1.53	As (ug/g)	1.000	< 1.000	< 1.000	< 0.04
Cd (ug/g)	3.900	3.200	4.900	0.16	Cu (ug/g)	5.000	3.000	9.000	0.21
Zn (ug/g)	29.000	11.000	65.000	1.20	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.08
Ni (ug/g)	28.000	20.000	43.000	1.16					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-180674

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LOCATION: LUDINGTON , MI BASIN: MICHIGAN PROJECT BEGAN: 7506 COMPLETE: 7506 ROW= 129

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 435630N, LONG 8630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 27222 TOTAL; 27222 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.14 TOTAL $/CMPM; 2.14

REMARKS: N&S BARS,N&S BASINS,0.06M-E TO 0.27M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.770	< 1.000	3.860	< 1011.84	COD (mg/g)	8.800	1.000	29.000	503.06
O&G (mg/g)	0.350	< 0.200	0.470	< 20.01	TKN (mg/g)	0.230	0.018	0.710	13.15
TOTAL P (mg/g)	0.105	0.048	0.270	6.00	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	35.000	17.000	62.000	2.00	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.06
Cd (ug/g)	3.000	0.300	4.900	0.17	Cu (ug/g)	5.000	3.000	9.000	0.29
Zn (ug/g)	26.000	11.000	65.000	1.49	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.11
Ni (ug/g)	25.000	14.000	43.000	1.43					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-180674

LOCATION: MANISTEE , MI BASIN: MICHIGAN PROJECT BEGAN: 7506 COMPLETE: 7507 ROW= 132

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 441430N, LONG 8622W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 28658 TOTAL; 28658 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.43 TOTAL $/CMPM; 2.43

REMARKS: N&S BARS, S. BASIN, CENTER BAR, 0.15M-W TO 0.41M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.480	< 1.000	4.880	< 848.28	COD (mg/g)	13.000	1.100	61.000	745.11
O&G (mg/g)	0.450	< 0.200	1.300	< 25.79	TKN (mg/g)	0.273	0.066	1.200	15.65
TOTAL P (mg/g)	0.091	0.048	0.260	5.22	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	25.000	14.000	58.000	1.43	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.06
Cd (ug/g)	4.700	3.000	5.500	0.27	Cu (ug/g)	6.000	1.000	19.000	0.34
Zn (ug/g)	16.000	3.000	47.000	0.92	Cr (ug/g)	4.000	< 2.000	11.000	< 0.23
Ni (ug/g)	23.000	11.000	35.000	1.32					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-170674

LOCATION: MANISTEE , MI BASIN: MICHIGAN PROJECT BEGAN: 7605 COMPLETE: 7605 ROW= 133

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 441430N, LONG 8622W
EQUIPMENT TYPE: HOPPER
QUANTITY(CMPM): PAY; 16124 TOTAL; 16124 DRY DENSITY(Kg/L)) 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.26 TOTAL $/CMPM; 2.26

REMARKS: N&S BARS,S. BASIN,0.15M-W TO 1.41M-E DRGED,DATA AVG FROM 0M TO 0.5M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.480	< 1.000	4.880	< 477.27	COD (mg/g)	13.000	1.100	61.000	419.22
O&G (mg/g)	0.450	< 0.200	1.300	< 14.51	TKN (mg/g)	0.273	0.066	1.200	8.80
TOTAL P (mg/g)	0.091	0.048	0.260	2.93	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	25.000	14.000	58.000	0.81	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.03
Cd (ug/g)	4.700	3.000	5.500	0.15	Cu (ug/g)	6.000	1.000	19.000	0.19
Zn (ug/g)	16.000	3.000	47.000	0.52	Cr (ug/g)	4.000	< 2.000	11.000	< 0.13
Ni (ug/g)	23.000	11.000	35.000	0.74					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-170674

LOCATION: MANISTEE , MI BASIN: MICHIGAN PROJECT BEGAN: 7706 COMPLETE: 7706 ROW= 134

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 441430N, LONG 8622W
EQUIPMENT TYPE: HOPPER
QUANTITY(CMPM): PAY; 25749 TOTAL; 25749 DRY DENSITY(Kg/L)) 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.68 TOTAL $/CMPM; 2.68

REMARKS: N.BAR,IN PTS BTWN 0.03M-W TO 1.44M-E DRGED,DATA AVG FROM 0M TO 0.5M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.970	< 1.000	4.880	< 1014.51	COD (mg/g)	18.700	1.100	61.000	963.01
O&G (mg/g)	0.410	< 0.200	1.300	< 21.11	TKN (mg/g)	0.275	0.066	1.200	14.16
TOTAL P (mg/g)	0.112	0.056	0.260	5.77	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	26.000	14.000	58.000	1.34	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.05
Cd (ug/g)	4.400	3.000	4.900	0.23	Cu (ug/g)	7.000	1.000	19.000	0.36
Zn (ug/g)	19.000	9.000	47.000	0.98	Cr (ug/g)	4.000	< 2.000	11.000	< 0.21
Ni (ug/g)	21.000	11.000	35.000	1.08					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-170674

LOCATION: MANISTEE , MI BASIN: MICHIGAN PROJECT BEGAN: 7804 COMPLETE: 7805 ROW= 135

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 441430N, LONG 8622W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 33105 TOTAL; 33105 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.84 TOTAL $/CMPM; 1.84

REMARKS: N BAR,IN PTS BTWN 0.04M-E TO 2.15M-E,DATA AVG FROM 0M TO 0.5M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.970	< 1.000	4.880	< 1304.34	COD (mg/g)	18.700	1.100	61.000	1238.13
O&G (mg/g)	0.410	< 0.200	1.300	< 27.15	TKN (mg/g)	0.275	0.066	1.200	18.21
TOTAL P (mg/g)	0.112	0.056	0.260	7.42	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	26.000	14.000	58.000	1.72	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.07
Cd (ug/g)	4.400	3.000	4.900	0.29	Cu (ug/g)	7.000	1.000	19.000	0.46
Zn (ug/g)	19.000	9.000	47.000	1.26	Cr (ug/g)	4.000	< 2.000	11.000	< 0.26
Ni (ug/g)	21.000	11.000	35.000	1.39					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-170674

LOCATION: MANISTEE , MI BASIN: MICHIGAN PROJECT BEGAN: 7906 COMPLETE: 7907 ROW= 136

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 441530N, LONG 8622W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 23379 TOTAL; 23379 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.58 TOTAL $/CMPM; 3.58

REMARKS: N.BAR,0.04M-E TO 1.46M-E DRGED,DATA AVG FROM 0M TO 0.5M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.480	< 1.000	4.880	< 692.02	COD (mg/g)	13.000	1.100	61.000	607.85
O&G (mg/g)	0.450	< 0.200	1.300	< 21.04	TKN (mg/g)	0.273	0.066	1.200	12.76
TOTAL P (mg/g)	0.091	0.048	0.260	4.25	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	25.000	14.000	48.000	1.17	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.05
Cd (ug/g)	4.700	3.000	5.500	0.22	Cu (ug/g)	6.000	1.000	19.000	0.28
Zn (ug/g)	16.000	3.000	47.000	0.75	Cr (ug/g)	4.000	< 2.000	11.000	< 0.19
Ni (ug/g)	23.000	11.000	35.000	1.08					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-170674

LOCATION: MUSKEGON , MI BASIN: MICHIGAN PROJECT BEGAN: 7506 COMPLETE: 7506 ROW= 142

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 431330N, LONG 862230W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 48145 TOTAL; 48145 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.39 TOTAL $/CMPM; 1.39

REMARKS: N&S BARS,BASIN AREA, S BAR TO 0.60M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 1011.05	COD (mg/g)	0.540	0.380	0.810	54.60
O&G (mg/g)	0.310	0.220	0.390	31.34	TKN (mg/g)	0.024	0.015	0.032	2.43
TOTAL P (mg/g)	0.063	0.034	0.140	6.37	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	30.000	19.000	36.000	3.03	As (ug/g)	< 1.000	< 1.000	< 2.000	< 0.10
Cd (ug/g)	1.400	< 0.200	4.000	< 0.14	Cu (ug/g)	2.000	< 1.000	4.000	< 0.20
Zn (ug/g)	8.000	6.000	9.000	0.81	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.20
Ni (ug/g)	15.000	13.000	17.000	1.52					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-190674

LOCATION: MUSKEGON , MI BASIN: MICHIGAN PROJECT BEGAN: 7604 COMPLETE: 7605 ROW= 143

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 431330N, LONG 862230W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 29188 TOTAL; 29188 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.96 TOTAL $/CMPM; 1.96

REMARKS: N&S BARS, BASIN AREA, OM TO 0.6M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 612.95	COD (mg/g)	0.540	0.380	0.810	33.10
O&G (mg/g)	0.310	0.220	0.390	19.00	TKN (mg/g)	0.024	0.015	0.032	1.47
TOTAL P (mg/g)	0.063	0.034	0.140	3.86	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	30.000	19.000	36.000	1.84	As (ug/g)	< 1.000	< 1.000	< 2.000	< 0.06
Cd (ug/g)	14.000	< 0.200	4.000	< 0.86	Cu (ug/g)	2.000	< 1.000	4.000	< 0.12
Zn (ug/g)	8.000	6.000	9.000	0.49	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.12
Ni (ug/g)	15.000	13.000	17.000	0.92					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-190674

LOCATION: MUSKEGON , MI BASIN: MICHIGAN PROJECT BEGAN: 7705 COMPLETE: 7706 ROW= 144

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 431330N, LONG 862230W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 57482 TOTAL; 57482 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.93 TOTAL $/CMPM; 1.93

REMARKS: N.S.&MID BARS, BASIN AREA, IN PTS BTWN 0.47E TO 0.17M-W DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 1207.12	COD (mg/g)	0.540	0.380	0.810	65.18
O&G (mg/g)	0.310	0.220	0.390	37.42	TKN (mg/g)	0.024	0.015	0.032	2.90
TOTAL P (mg/g)	0.063	0.034	0.140	7.60	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	30.000	19.000	36.000	3.62	As (ug/g)	< 1.000	< 1.000	< 2.000	< 0.12
Cd (ug/g)	1.400	< 0.200	4.000	< 0.17	Cu (ug/g)	2.000	< 1.000	4.000	< 0.24
Zn (ug/g)	8.000	6.000	9.000	0.97	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.24
Ni (ug/g)	15.000	13.000	17.000	1.81					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-190674

LOCATION: MUSKEGON , MI BASIN: MICHIGAN PROJECT BEGAN: 7806 COMPLETE: 7806 ROW= 145

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 431330N, LONG 862230W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 23954 TOTAL; 23954 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.47 TOTAL $/CMPM; 2.47

REMARKS: MID&OUT BAR, IN PTS BTWN 0.18M TO 1.99M DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.000	< 1.000	< 1.000	503.03	COD (mg/g)	0.540	0.380	0.810	27.16
O&G (mg/g)	0.310	0.220	0.390	15.59	TKN (mg/g)	0.024	0.015	0.032	1.21
TOTAL P (mg/g)	0.063	0.034	0.140	3.17	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	30.000	19.000	36.000	1.51	As (ug/g)	< 1.000	< 1.000	< 2.000	< 0.05
Cd (ug/g)	1.400	< 0.200	4.000	< 0.07	Cu (ug/g)	2.000	< 1.000	4.000	< 0.10
Zn (ug/g)	8.000	6.000	9.000	0.40	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.10
Ni (ug/g)	15.000	13.000	17.000	0.75					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-190674

LOCATION: MUSKEGON , MI BASIN: MICHIGAN PROJECT BEGAN: 7904 COMPLETE: 7904 ROW= 146

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 431330N, LONG 862230W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 21348 TOTAL; 21348 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.67 TOTAL $/CMPM; 2.67

REMARKS: N&S BARS, 0.25M-E TO 0.43M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 448.31	COD (mg/g)	0.490	0.420	0.560	21.97
O&G (mg/g)	0.310	0.220	0.390	13.90	TKN (mg/g)	0.024	0.015	0.032	1.08
TOTAL P (mg/g)	0.038	0.034	0.042	1.70	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	32.000	29.000	35.000	1.43	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04
Cd (ug/g)	0.600	< 0.200	1.000	< 0.03	Cu (ug/g)	2.000	< 1.000	3.000	< 0.09
Zn (ug/g)	9.000	8.000	9.000	0.40	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.09
Ni (ug/g)	16.000	14.000	17.000	0.72					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-190674

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LOCATION: PENTWATER , MI BASIN: MICHIGAN PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 151

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4346N, LONG 8629W
EQUIPMENT TYPE: CLAM, HYDRAULIC

QUANTITY(CMPM): PAY; 7105 TOTAL; 7105 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 11.06 TOTAL $/CMPM; 11.06

REMARKS: MIDDLE BAR & 0.13M-W TO 0.12M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 149.21	COD (mg/g)	0.410	0.400	0.420	6.12
O&G (mg/g)	0.350	0.310	0.410	5.22	TKN (mg/g)	0.035	< 0.019	0.052	< 0.52
TOTAL P (mg/g)	0.035	0.034	0.036	0.52	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	38.000	22.000	60.000	0.57	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.01
Cd (ug/g)	2.600	< 0.200	4.400	< 0.04	Cu (ug/g)	3.000	1.000	4.000	0.04
Zn (ug/g)	10.000	8.000	12.000	0.15	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.03
Ni (ug/g)	18.000	12.000	27.000	0.27					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-180674

LOCATION: PENTWATER , MI BASIN: MICHIGAN PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 152

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4346N, LONG 8629W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 15355 TOTAL; 15355 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.84 TOTAL $/CMPM; 7.84

REMARKS: 0.13M-W TO 0.13M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 322.46	COD (mg/g)	0.410	0.400	0.420	13.22
O&G (mg/g)	0.350	0.310	0.410	11.29	TKN (mg/g)	0.035	< 0.019	0.052	< 1.13
TOTAL P (mg/g)	0.035	0.034	0.036	1.13	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	38.000	22.000	60.000	1.23	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.03
Cd (ug/g)	2.600	< 0.200	4.400	< 0.08	Cu (ug/g)	3.000	1.000	4.000	0.10
Zn (ug/g)	10.000	8.000	12.000	0.32	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.06
Ni (ug/g)	18.000	12.000	27.000	0.58					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-180674

LOCATION: PENTWATER , MI BASIN: MICHIGAN PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 153

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4346N, LONG 8629W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 9323 TOTAL; 9323 DRY DENSITY(Kg/L); 2.10
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.98 TOTAL $/CMPM; 6.98

REMARKS: MIDDLE BAR & 0.13M-W TO 0.11M-W

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 195.78	COD (mg/g)	0.410	0.400	0.420	8.03
O&G (mg/g)	0.350	0.310	0.410	6.85	TKN (mg/g)	0.035	< 0.019	0.052	< 0.69
TOTAL P (mg/g)	0.035	0.034	0.036	0.69	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	38.000	22.000	60.000	0.74	As (ug/g)	< 1.000	< 1.000	< 1.000	< 0.02
Cd (ug/g)	2.600	< 0.200	4.400	< 0.05	Cu (ug/g)	3.000	1.000	4.000	0.06
Zn (ug/g)	10.000	8.000	12.000	0.20	Cr (ug/g)	< 2.000	< 2.000	< 2.000	< 0.04
Ni (ug/g)	18.000	12.000	27.000	0.35					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOLS
SAMPLING DATES: EPA-180674

LOCATION: PORTAGE LAKE , MI BASIN: MICHIGAN PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 154

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4421N, LONG 8618W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 3272 TOTAL) 3272 DRY DENSITY(Kg/L)) 1.94
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 7.97 TOTAL $/CMPM) 7.97

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.650	0.600	0.700	41.15	COD (mg/g)	3.720	3.360	4.080	23.55
O&G (mg/g)	0.115	0.019	0.211	0.73	TOTAL P (mg/g)	0.078	0.027	0.128	0.49
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.00	Pb (ug/g)	3.200	0.000	6.400	0.02
As (ug/g)	1.000	1.000	1.000	0.01	Zn (ug/g)	14.000	10.000	18.000	0.09
Ni (ug/g)	1.900	0.000	3.800	0.01					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

255

LOCATION: PORTAGE LAKE , MI BASIN: MICHIGAN PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 155

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4421N, LONG 8618W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY) 15292 TOTAL) 15292 DRY DENSITY(Kg/L)) 1.94
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 3.28 TOTAL $/CMPM) 3.28

REMARKS: BAR AT ENTRANCE, 0.14M-W TO 0.09M-E

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.600	0.600	0.600	177.54	COD (mg/g)	3.360	3.360	3.360	99.42
O&G (mg/g)	0.019	0.019	0.019	0.56	TOTAL P (mg/g)	0.128	0.128	0.128	3.79
Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.01	Pb (ug/g)	6.400	6.400	6.400	0.19
As (ug/g)	1.000	1.000	1.000	0.03	Zn (ug/g)	18.000	18.000	18.000	0.53
Ni (ug/g)	38.000	38.000	38.000	1.12					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-160671

LOCATION: SAUGATUCK , MI BASIN: MICHIGAN PROJECT BEGAN: 7600 COMPLETE: 7600 ROW= 170

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4240N, LONG 8615W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 1084 TOTAL; 1084 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 17.83 TOTAL $/CMPM; 17.83

REMARKS: 0.05M-W TO 0.13M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 21.68					

SAMPLING DATES: FWPCA-1967

LOCATION: SAUGATUCK , MI BASIN: MICHIGAN PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 172

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4240N, LONG 8615W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 4139 TOTAL; 4139 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 19.12 TOTAL $/CMPM; 19.12

REMARKS: OUTER BAR, 0.01M-W TO 0.17M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 82.78					

SAMPLING DATES: FWPCA-1967

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7505 COMPLETE: 7505 ROW= 181

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4207N, LONG 8631W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 46299 TOTAL; 46299 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.67 TOTAL $/CMPM; 1.67

REMARKS: N&S BARS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	263.90	COD (mg/g)	0.710	0.710	0.710	62.46
O&G (mg/g)	0.270	0.270	0.270	23.75	TKN (mg/g)	0.042	0.042	0.042	3.69
TOTAL P (mg/g)	0.085	0.085	0.085	7.48					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7605 COMPLETE: 7606 ROW= 182

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4207N, LONG 8631W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 62619 TOTAL; 62619 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.19 TOTAL $/CMPM; 1.19

REMARKS: N,S&OUT BARS, BORROW AREA DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	356.93	COD (mg/g)	0.710	0.710	0.710	84.47
O&G (mg/g)	0.270	0.270	0.270	32.12	TKN (mg/g)	0.042	0.042	0.042	5.00
TOTAL P (mg/g)	0.085	0.085	0.085	10.11					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7704 COMPLETE: 7705 ROW= 183

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4207N, LONG 8631W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 120403 TOTAL) 120403 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 0.94 TOTAL $/CMPM) 0.94

REMARKS: N,S & OUT BARS, BORROW AREA DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	686.30	COD (mg/g)	0.710	0.710	0.710	162.42
O&G (mg/g)	0.270	0.270	0.270	61.77	TKN (mg/g)	0.042	0.042	0.042	9.61
TOTAL P (mg/g)	0.085	0.085	0.085	19.45					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7805 COMPLETE: 7806 ROW= 184

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4207N, LONG 8631W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 59500 TOTAL) 59500 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 3.24 TOTAL $/CMPM) 3.24

REMARKS: N BAR, BORROW AREA, IN PTS BTWN 0.21M-W TO 0.85 M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	339.15	COD (mg/g)	0.710	0.710	0.710	80.27
O&G (mg/g)	0.270	0.270	0.270	30.52	TKN (mg/g)	0.042	0.042	0.042	4.75
TOTAL P (mg/g)	0.085	0.085	0.085	9.61					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7905 COMPLETE: 7906 ROW= 188

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: CONFINED-WHIRLPOOL
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 24385 TOTAL) 24385 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 41553 DREDGING $/CMPM) 2.02 TOTAL $/CMPM) 6.71

REMARKS: BORROW AREA, IN PTS BTWN 0.36M-W TO 1.10M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.580	1.100	18.900	4438.56	COD (mg/g)	117.800	3.800	220.000	5457.85
O&G (mg/g)	3.238	0.260	7.865	150.02	TKN (mg/g)	3.750	0.110	7.900	173.74
TOTAL P (mg/g)	1.010	0.110	2.300	46.79	Hg (ug/g)	0.300	< 0.200	0.400	< 0.01
Pb (ug/g)	101.000	< 15.000	190.000	< 4.68	As (ug/g)	5.000	< 2.000	12.000	< 0.23
Cd (ug/g)	6.000	< 3.000	12.000	< 0.28	Cu (ug/g)	89.000	20.000	220.000	4.12
Zn (ug/g)	216.000	40.000	560.000	10.01	Cr (ug/g)	97.000	< 15.000	220.000	< 4.49
Ni (ug/g)	58.000	< 15.000	120.000	< 2.69					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOL
SAMPLING DATES: EPA-240674

LOCATION: ST JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7805 COMPLETE: 7806 ROW= 185

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: CONFINED-WHIRLPOOL CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 6361 TOTAL) 6361 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 0.00 TOTAL $/CMPM) 7.97

REMARKS: N BAR, BORROW AREA, IN PTS BTWN 0.21M-W TO 0.85M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.000	1.100	18.900	1208.59	COD (mg/g)	125.000	3.800	220.000	1510.74
O&G (mg/g)	3.858	0.260	7.865	46.63	TKN (mg/g)	4.360	0.110	7.900	52.69
TOTAL P (mg/g)	1.150	0.110	2.300	13.90	Hg (ug/g)	0.300	< 0.200	0.400	< 0.00
Pb (ug/g)	122.000	65.000	190.000	1.47	As (ug/g)	5.000	< 2.000	12.000	< 0.06
Cd (ug/g)	7.000	< 3.000	10.000	< 0.08	Cu (ug/g)	110.000	20.000	220.000	1.33
Zn (ug/g)	285.000	40.000	560.000	3.44	Cr (ug/g)	92.000	< 15.000	170.000	< 1.11
Ni (ug/g)	51.000	< 15.000	75.000	< 0.62					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOL
SAMPLING DATES: EPA-191072/260374

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7905 COMPLETE: 7906 ROW= 189

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 4207N, LONG 8631W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 73689 TOTAL; 73689 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 2.02

REMARKS: BORROW AREA, IN PTS BTWN 0.36M-W TO 1.10M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.300	0.300	0.300	420.03	COD (mg/g)	0.710	0.710	0.710	99.41
O&G (mg/g)	0.270	0.270	0.270	37.80	TKN (mg/g)	0.042	0.042	0.042	5.88
TOTAL P (mg/g)	0.085	0.085	0.085	11.90					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: ST. JOSEPH , MI BASIN: MICHIGAN PROJECT BEGAN: 7806 COMPLETE: 7807 ROW= 187

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: CONFINED-WHIRLPOOL CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 19390 TOTAL; 19390 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.24 TOTAL $/CMPM; 7.95

REMARKS: N BAR, BORROW AREA, IN PTS BTWN 0.21M-W TO 0.85M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.000	1.100	18.900	3684.10	COD (mg/g)	125.000	3.800	220.000	4605.13
O&G (mg/g)	3.858	0.260	7.865	142.13	TKN (mg/g)	4.360	0.110	7.900	160.63
TOTAL P (mg/g)	1.150	0.110	2.300	42.37	Hg (ug/g)	0.300	< 0.200	0.400	< 0.01
Pb (ug/g)	122.000	65.000	190.000	4.49	As (ug/g)	5.000	< 2.000	12.000	< 0.18
Cd (ug/g)	7.000	< 3.000	10.000	< 0.26	Cu (ug/g)	110.000	20.000	220.000	4.05
Zn (ug/g)	285.000	40.000	560.000	10.50	Cr (ug/g)	92.000	< 15.000	170.000	< 3.39
Ni (ug/g)	51.000	< 15.000	75.000	< 1.88					

OTHER PARAMETERS Ba,Co,Fe,Mn,PHENOL
SAMPLING DATES: EPA-240674

LOCATION: SOUTH HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7505 COMPLETE: 7505 ROW= 174

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 432430N, LONG 861930W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 34247 TOTAL; 34247 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.91 TOTAL $/CMPM; 1.91

REMARKS: N&S BARS, 0.23M-W TO 0.42M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.800	0.100	3.100	547.95	COD (mg/g)	11.910	0.500	47.000	815.76
O&G (mg/g)	0.379	0.095	0.980	25.96	TKN (mg/g)	0.190	0.009	0.740	13.01
TOTAL P (mg/g)	0.179	0.097	0.400	12.26					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: SOUTH HAVEN , MI BASIN: MICHIGAN PROJECT BEGAN: 7607 COMPLETE: 7607 ROW= 176

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 432430N, LONG 861930W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 62619 TOTAL; 62619 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.85 TOTAL $/CMPM; 2.85

REMARKS: N&S BARS, 0.23M-W TO 0.19M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.850	0.100	3.100	1064.52	COD (mg/g)	12.700	0.500	47.000	1590.52
O&G (mg/g)	0.384	0.095	0.980	48.09	TKN (mg/g)	0.195	0.009	0.740	24.42
TOTAL P (mg/g)	0.182	0.097	0.040	22.79					

OTHER PARAMETERS Fe,PHENOLS
SAMPLING DATES: EPA-191072

LOCATION: WHITE LAKE , MI BASIN: MICHIGAN PROJECT BEGAN: 7506 COMPLETE: 7506 ROW= 196

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4321N, LONG 8625W, TO 4324N, 862630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 29583 TOTAL; 29583 DRY DENSITY(Kg/L): 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.56 TOTAL $/CMPM; 1.56

REMARKS: N&S BARS, N BAR TO 0.13M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 562.08					

SAMPLING DATES: FWPCA-1967

LOCATION: WHITE LAKE , MI BASIN: MICHIGAN PROJECT BEGAN: 7605 COMPLETE: 7605 ROW= 197

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4321N, LONG 8625W TO 4324N, 862630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 36990 TOTAL; 36990 DRY DENSITY(Kg/L): 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.13 TOTAL $/CMPM; 2.13

REMARKS: N BAR, N BAR TO 0.13M-E DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 702.81					

SAMPLING DATES: FWPCA-1967

LOCATION: GREEN BAY HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7504 COMPLETE: 7505 ROW= 56

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-BAYPORT CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 152110 TOTAL: 189193 DRY DENSITY(Kg/L): 1.23
COSTS: CAPITAL CONTAINMENT: 17973 O&M CONTAINMENT: 24706 DREDGING $/CMPM: 1.17 TOTAL $/CMPM: 1.39

REMARKS: ENTRANCE & RIVER CHANNELS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.400	4.110	14.700	26442.37	COD (mg/g)	165.000	73.000	210.000	38271.85
O&G (mg/g)	2.940	< 0.600	4.200	< 681.93	TKN (mg/g)	5.160	2.300	6.700	1196.87
NH3 (mg/g)	0.415	0.095	0.690	96.26	TOTAL P (mg/g)	1.200	0.610	1.400	278.34
PCB (ug/g)	2.540	0.470	4.080	0.59	Hg (ug/g)	0.600	< 0.100	1.300	< 0.14
Pb (ug/g)	108.000	28.000	160.000	25.05	As (ug/g)	9.000	4.000	11.000	2.09
Cd (ug/g)	2.000	2.000	3.000	0.46	Cu (ug/g)	55.000	17.000	75.000	12.76
Zn (ug/g)	155.000	45.000	220.000	35.95	Cr (ug/g)	85.000	29.000	120.000	19.72
Ni (ug/g)	20.000	8.000	24.000	4.64					

OTHER PARAMETERS PEST. < DET. LIMIT
SAMPLING DATES: EPA-041077/051077

263

LOCATION: GREEN BAY HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7706 COMPLETE: 7707 ROW= 57

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-BAYPORT CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 244367 TOTAL: 244367 DRY DENSITY(Kg/L): 1.23
COSTS: CAPITAL CONTAINMENT: 23215 O&M CONTAINMENT: 36601 DREDGING $/CMPM: 1.92 TOTAL $/CMPM: 2.16

REMARKS: ENTRANCE & RIVER CHANNELS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.300	11.800	14.700	39845.99	COD (mg/g)	188.000	150.000	210.000	56323.66
O&G (mg/g)	3.530	2.600	4.200	1057.57	TKN (mg/g)	5.880	4.400	6.700	1761.61
NH3 (mg/g)	0.495	0.350	0.690	148.30	TOTAL P (mg/g)	1.350	1.200	1.400	404.45
PCB (ug/g)	3.060	2.240	4.080	0.92	Hg (ug/g)	0.700	< 0.100	1.300	< 0.21
Pb (ug/g)	128.000	110.000	160.000	38.35	As (ug/g)	10.000	8.000	11.000	3.00
Cd (ug/g)	3.000	2.000	3.000	0.90	Cu (ug/g)	65.000	54.000	75.000	19.47
Zn (ug/g)	183.000	150.000	220.000	54.83	Cr (ug/g)	99.000	84.000	120.000	29.66
Ni (ug/g)	24.000	22.000	24.000	7.19					

OTHER PARAMETERS PEST. < DET. LIMIT
SAMPLING DATES: EPA-041077/051077

264

LOCATION: GREEN BAY HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7810 COMPLETE: 7811 ROW= 58

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-BAYPORT CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 130593 TOTAL; 160700 DRY DENSITY(Kg/L): 1.23
COSTS: CAPITAL CONTAINMENT; 15267 O&M CONTAINMENT; 203728 DREDGING $/CMPM; 1.79 TOTAL $/CMPM; 3.16

REMARKS: ENTRANCE & RIVER CHANNELS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.800	12.400	14.700	27188.51	COD (mg/g)	202.000	150.000	260.000	39797.68
O&G (mg/g)	4.000	3.400	4.800	788.07	TKN (mg/g)	6.260	4.400	7.700	1233.33
NH3 (mg/g)	0.668	0.350	1.000	131.61	TOTAL P (mg/g)	1.600	1.200	2.500	315.23
PCB (ug/g)	4.910	2.600	9.820	0.97	Hg (ug/g)	0.900	< 0.100	1.400	< 0.18
Pb (ug/g)	144.000	110.000	160.000	28.37	As (ug/g)	10.000	8.000	11.000	1.97
Cd (ug/g)	3.000	2.000	4.000	0.59	Cu (ug/g)	75.000	63.000	86.000	14.78
Zn (ug/g)	220.000	170.000	270.000	43.34	Cr (ug/g)	116.000	93.000	140.000	22.85
Ni (ug/g)	22.000	21.000	24.000	4.33					

OTHER PARAMETERS PEST. < DET. LIMIT
SAMPLING DATES: EPA-041077/051077

LOCATION: GREEN BAY HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7905 COMPLETE: 7906 ROW= 59

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-BAYPORT CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 339333 TOTAL; 339333 DRY DENSITY(Kg/L): 1.19
COSTS: CAPITAL CONTAINMENT; 32237 O&M CONTAINMENT; 131000 DREDGING $/CMPM; 1.64 TOTAL $/CMPM; 2.12

REMARKS: OUTER HBR & RIVER CHANNELS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.900	3.630	15.300	39976.82	COD (mg/g)	160.000	70.000	260.000	64609.00
O&G (mg/g)	2.810	0.870	4.600	1134.70	TKN (mg/g)	5.140	1.500	7.700	2075.56
NH3 (mg/g)	0.506	0.095	1.000	204.33	TOTAL P (mg/g)	1.360	0.610	2.500	549.18
PCB (ug/g)	4.200	0.470	9.820	1.70	Hg (ug/g)	0.600	0.200	1.000	0.24
Pb (ug/g)	106.000	28.000	170.000	42.80	As (ug/g)	7.000	4.000	11.000	2.83
Cd (ug/g)	3.000	< 1.000	4.000	< 1.21	Cu (ug/g)	52.000	12.000	82.000	21.00
Zn (ug/g)	153.000	44.000	250.000	61.78	Cr (ug/g)	84.000	27.000	130.000	33.92
Ni (ug/g)	18.000	5.000	24.000	7.27					

OTHER PARAMETERS PEST. < DET. LIMIT
SAMPLING DATES: EPA-041077/051077

LOCATION: KENOSHA HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7607 COMPLETE: 7608 ROW= 54

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-KENOSHA CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 42994 TOTAL; 49219 DRY DENSITY(Kg/L)) 1.36
COSTS: CAPITAL CONTAINMENT; 709738 O&M CONTAINMENT; 111429 DREDGING $/CMPM; 2.60 TOTAL $/CMPM; 19.28

REMARKS: INNER BASIN & ENTRANCE DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.160	7.200	10.900	6108.96	COD (mg/g)	81.890	49.500	110.600	5461.39
O&G (mg/g)	2.920	0.101	10.638	194.74	TKN (mg/g)	1.540	0.877	2.350	102.71
Hg (ug/g)	1.000	0.810	1.140	0.07	Pb (ug/g)	128.000	51.000	307.000	8.54
Zn (ug/g)	186.000	82.000	370.000	12.40					

SAMPLING DATES: EPA-180673

LOCATION: KENOSHA HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7708 COMPLETE: 7708 ROW= 55

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: CONFINED-KENOSHA CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 42022 TOTAL; 42022 DRY DENSITY(Kg/L)) 1.67
COSTS: CAPITAL CONTAINMENT; 605957 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.45 TOTAL $/CMPM; 18.87

REMARKS: INNER BASIN & ENTRANCE DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.160	7.200	10.900	6408.94	COD (mg/g)	81.890	49.500	110.600	5729.57
O&G (mg/g)	2.920	0.101	10.638	204.30	TKN (mg/g)	1.540	0.877	2.350	107.75
Hg (ug/g)	1.000	0.810	1.140	0.07	Pb (ug/g)	128.000	51.000	307.000	8.96
Zn (ug/g)	186.000	82.000	370.000	13.01					

SAMPLING DATES: EPA-180673

265

LOCATION: MANITOWOC HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7608 COMPLETE: 7609 ROW= 50

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MANITOWOC CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 27396 TOTAL) 29627 DRY DENSITY(Kg/L) 1.19
COSTS: CAPITAL CONTAINMENT) 200871 O&M CONTAINMENT) 41236 DREDGING $/CMPM) 3.99 TOTAL $/CMPM) 12.16

REMARKS: MANITOWOC R. & OUTER HARBOR DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.720	< 1.000	8.500	< 2008.18	COD (mg/g)	58.200	6.000	98.000	2043.29
O&G (mg/g)	1.230	0.700	2.400	43.18	TKN (mg/g)	2.650	0.480	9.400	93.04
NH3 (mg/g)	1.480	0.044	3.700	51.96	TOTAL P (mg/g)	0.948	0.240	2.900	33.28
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	88.000	16.000	269.000	3.09
As (ug/g)	4.000	< 2.000	5.000	< 0.14	Cd (ug/g)	2.000	< 2.000	3.000	< 0.07
Cu (ug/g)	28.000	8.000	73.000	0.98	Zn (ug/g)	89.000	29.000	150.000	3.12
Cr (ug/g)	25.000	9.000	47.000	0.88	Ni (ug/g)	30.000	16.000	38.000	1.05

OTHER PARAMETERS T SOLIDS,Mn,Mg,Fe
SAMPLING DATES: EPA-061175

LOCATION: MANITOWOC HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7707 COMPLETE: 7707 ROW= 51

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: CONFINED-MANITOWOC CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 52390 TOTAL) 52390 DRY DENSITY(Kg/L) 1.87
COSTS: CAPITAL CONTAINMENT) 355204 O&M CONTAINMENT) 80705 DREDGING $/CMPM) 3.55 TOTAL $/CMPM) 11.87

REMARKS: MANITOWOC R., OUTER HBR & APPROACH DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.870	< 1.000	8.500	< 5735.42	COD (mg/g)	60.200	6.000	98.000	5881.98
O&G (mg/g)	1.340	0.700	2.400	130.93	TKN (mg/g)	2.550	0.480	9.400	249.15
NH3 (mg/g)	1.440	0.044	3.700	140.70	TOTAL P (mg/g)	0.934	0.240	2.900	91.26
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	97.000	16.000	269.000	9.48
As (ug/g)	4.000	< 2.000	7.000	< 0.39	Cd (ug/g)	2.000	< 2.000	3.000	< 0.20
Cu (ug/g)	31.000	8.000	73.000	3.03	Zn (ug/g)	95.000	29.000	150.000	9.28
Cr (ug/g)	25.000	9.000	47.000	2.44	Ni (ug/g)	30.000	16.000	38.000	2.93

OTHER PARAMETERS T SOLIDS,Mn,Mg,Fe
SAMPLING DATES: EPA-061175

LOCATION: MANITOWOC HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7804 COMPLETE: 7804 ROW= 52

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MANITOWOC CONFINED DISPOSAL SITE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 11240 TOTAL; 11240 DRY DENSITY(Kg/L); 1.47
COSTS: CAPITAL CONTAINMENT; 76207 O&M CONTAINMENT; 0 DREDGING $/CMPM; 13.05 TOTAL $/CMPM; 19.83

REMARKS: VARIOUS PTS IN MANITOWOC R. DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.190	7.420	8.500	1355.98	COD (mg/g)	86.600	69.000	98.000	1433.79
O&G (mg/g)	1.700	1.200	2.400	28.15	TKN (mg/g)	2.700	2.300	3.200	44.70
NH3 (mg/g)	1.600	1.200	2.000	26.49	TOTAL P (mg/g)	1.085	0.890	1.300	17.96
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	147.000	78.000	269.000	2.43
As (ug/g)	4.000	4.000	4.000	0.07	Cd (ug/g)	2.000	< 2.000	3.000	< 0.03
Cu (ug/g)	44.000	27.000	73.000	0.73	Zn (ug/g)	132.000	98.000	150.000	2.19
Cr (ug/g)	35.000	25.000	47.000	0.58	Ni (ug/g)	36.000	35.000	38.000	0.60

OTHER PARAMETERS T.SOLIDS,Mn,Mg,Fe
SAMPLING DATES: EPA-061175

LOCATION: MANITOWOC HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7904 COMPLETE: 7904 ROW= 53

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MANITOWOC CONFINED DISPOSAL SITE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 11698 TOTAL; 11698 DRY DENSITY(Kg/L); 1.19
COSTS: CAPITAL CONTAINMENT; 79312 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.09 TOTAL $/CMPM; 13.87

REMARKS: VARIOUS PTS IN MANITOWOC R. DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.870	4.040	8.500	952.33	COD (mg/g)	71.200	42.000	98.000	986.98
O&G (mg/g)	1.500	0.800	2.400	20.79	TKN (mg/g)	3.570	1.200	9.400	49.49
NH3 (mg/g)	1.790	0.640	3.700	24.81	TOTAL P (mg/g)	1.080	0.240	2.900	14.97
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	119.000	63.000	269.000	1.65
As (ug/g)	3.000	< 2.000	4.000	< 0.04	Cd (ug/g)	2.000	< 2.000	3.000	< 0.03
Cu (ug/g)	29.000	15.000	73.000	0.40	Zn (ug/g)	108.000	49.000	150.000	1.50
Cr (ug/g)	30.000	15.000	47.000	0.42	Ni (ug/g)	34.000	26.000	38.000	0.47

OTHER PARAMETERS T. SOLIDS,Mn,Mg,Fe
SAMPLING DATES: EPA-061175

LOCATION: MILWAUKEE HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7506 COMPLETE: 7507 ROW= 44

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MILWAUKEE CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 121847 TOTAL; 126605 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT; 616566 O&M CONTAINMENT; 27950 DREDGING $/CMPM; 1.65 TOTAL $/CMPM; 6.74

REMARKS: OUTER HARBOR & RIVER DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.630	3.500	14.400	20187.17	COD (mg/g)	98.600	29.100	180.600	18724.88
O&G (mg/g)	5.530	0.482	7.420	1050.19	TKN (mg/g)	3.420	1.020	4.530	649.48
Hg (ug/g)	0.700	< 0.400	1.500	< 0.13	Pb (ug/g)	307.000	45.000	431.000	58.30
Zn (ug/g)	355.000	130.000	550.000	67.42					

SAMPLING DATES: EPA-210673

LOCATION: MILWAUKEE HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7603 COMPLETE: 7607 ROW= 45

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MILWAUKEE CONFINED DISPOSAL AREA
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 234604 TOTAL; 234604 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT; 1142520 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.12 TOTAL $/CMPM; 9.99

REMARKS: VARIOUS RIVERS & CANALS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.940	8.000	13.000	38498.52	COD (mg/g)	88.200	55.200	136.000	31038.11
O&G (mg/g)	6.830	2.400	10.200	2403.52	TKN (mg/g)	3.250	2.300	4.460	1143.69
Hg (ug/g)	< 0.400	< 0.400	0.400	< 0.14	Pb (ug/g)	310.000	150.000	410.000	109.09
Zn (ug/g)	304.000	130.000	550.000	106.98					

SAMPLING DATES: EPA-210673

LOCATION: PORT WASHINGTON HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7709 COMPLETE: 7710 ROW= 43

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MILWAUKEE CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 10989 TOTAL) 11063 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 53877 O&M CONTAINMENT) 0 DREDGING $/CMPM) 21.33 TOTAL $/CMPM) 26.20

REMARKS: OUTER TURNING BASIN & ENTRANCE CHANNEL DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.370	2.430	4.300	521.95	COD (mg/g)	43.000	16.000	70.000	665.99
O&G (mg/g)	1.100	0.700	1.500	17.04	TKN (mg/g)	1.260	0.510	2.000	19.52
NH3 (mg/g)	0.118	0.055	0.180	1.83	TOTAL P (mg/g)	0.423	0.280	0.565	6.55
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	60.000	52.000	68.000	0.93
As (ug/g)	< 2.000	< 2.000	< 2.000	< 0.03	Cd (ug/g)	2.600	2.400	2.800	0.04
Cu (ug/g)	25.000	16.000	34.000	0.39	Zn (ug/g)	68.000	53.000	83.000	1.05
Cr (ug/g)	14.000	10.000	18.000	0.22	Ni (ug/g)	19.000	< 10.000	28.000	< 0.29

OTHER PARAMETERS T SOLIDS,Mn,Mg,Fe
SAMPLING DATES: EPA-071175

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LOCATION: BAYFIELD , ON BASIN: HURON PROJECT BEGAN: 7511 COMPLETE: 7512 ROW= 24

PHYSICAL DATA

MATERIAL: ORGANIC SILTS AND SAND DISPOSAL METHOD: LAND
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 21014 TOTAL) 25200 DRY DENSITY(Kg/L)) 1.50
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 6.21 TOTAL $/CMPM) 6.50

REMARKS: ACCESS TO MARINAS. HIGH COST DUE TO TRUCKING TO LAND DISPOSAL.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.500	0.500	0.600	189.00	COD (mg/g)	9.300	2.400	20.000	351.54
O&G (mg/g)	0.860	0.800	0.900	32.51	TKN (mg/g)	0.058	0.100	0.020	2.19
TOTAL P (mg/g)	0.075	0.075	0.084	2.84					

SAMPLING DATES:

LOCATION: MILWAUKEE HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7705 COMPLETE: 7706 ROW= 46

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MILWAUKEE CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 43341 TOTAL; 43341 DRY DENSITY(Kg/L); 1.50
COSTS: CAPITAL CONTAINMENT; 211071 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.32 TOTAL $/CMPM; 8.19

REMARKS: OUTER HARBOR & ENTRANCE CHANNEL DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.830	3.500	14.400	6390.63	COD (mg/g)	93.800	29.100	180.600	6098.08
O&G (mg/g)	5.000	0.482	7.420	325.06	TKN (mg/g)	3.340	1.020	4.530	217.14
Hg (ug/g)	0.800	< 0.400	1.500	< 0.05	Pb (ug/g)	272.000	45.000	431.000	17.68
Zn (ug/g)	290.000	130.000	510.000	18.85					

SAMPLING DATES: EPA-210673

LOCATION: MILWAUKEE HARBOR , WI BASIN: MICHIGAN PROJECT BEGAN: 7805 COMPLETE: 7808 ROW= 47

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-MILWAUKEE CONFINED DISPOSAL SITE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 159334 TOTAL; 159334 DRY DENSITY(Kg/L); 1.50
COSTS: CAPITAL CONTAINMENT; 775957 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.74 TOTAL $/CMPM; 10.61

REMARKS: VARIOUS REACHES OF HARBOR, CANALS & RIVERS DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.840	3.500	14.400	25907.71	COD (mg/g)	90.200	29.100	180.600	21557.89
O&G (mg/g)	6.610	0.482	10.200	1579.80	TKN (mg/g)	3.250	1.020	4.530	776.75
Hg (ug/g)	0.600	< 0.400	1.500	< 0.14	Pb (ug/g)	300.000	45.000	431.000	71.70
Zn (ug/g)	318.000	130.000	550.000	76.00					

SAMPLING DATES: EPA-210673

LOCATION: GRAND BEND , OH BASIN: HURON PROJECT BEGAN: 7500 COMPLETE: 7507 ROW= 18

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: LAND, ALONG BEACH SOUTH OF ENTRANCE CHANNEL
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY: 8333 TOTAL: 10000 DRY DENSITY(Kg/L): 1.70
COSTS: CAPITAL CONTAINMENT: 0 , O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.26 TOTAL $/CMPM: 4.50

REMARKS: PROJECT BEGAN 7411.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.200	3.200	7.300	884.00	COD (mg/g)	46.000	40.000	50.000	782.00
O&G (mg/g)	0.623	0.550	0.660	10.59	TKN (mg/g)	1.000	< 0.500	1.200	< 17.00
TOTAL P (mg/g)	0.440	0.260	0.520	7.48	Pb (ug/g)	29.100	17.800	34.800	0.49
Zn (ug/g)	42.000	17.800	61.000	0.71					

SAMPLING DATES:

LOCATION: GRAND BEND , OH BASIN: HURON PROJECT BEGAN: 7806 COMPLETE: 7810 ROW= 19

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: OPEN LAKE- LAT 4319N, LONG 8148W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY: 11611 TOTAL: 15100 DRY DENSITY(Kg/L): 1.70
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 6.33 TOTAL $/CMPM: 6.55

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.000	0.700	1.500	256.70	COD (mg/g)	3.500	1.300	8.000	89.85
O&G (mg/g)	0.510	0.360	0.680	13.09	TKN (mg/g)	0.400	< 0.100	0.800	< 10.27
TOTAL P (mg/g)	0.120	0.110	0.130	3.08	Hg (ug/g)	0.080	0.070	0.100	0.00

SAMPLING DATES:

LOCATION: GODERICH , ON BASIN: HURON PROJECT BEGAN: 7507 COMPLETE: 7510 ROW= 20

PHYSICAL DATA

MATERIAL: SAND SILT, CLAY DISPOSAL METHOD: OPEN LAKE- LAT 433715N, LONG 814920W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 108015 TOTAL; 129600 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.74 TOTAL $/CMPM; 3.85

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.200	0.900	6.000	6842.88	COD (mg/g)	33.000	6.000	66.000	7056.72
O&G (mg/g)	1.440	1.770	2.180	307.93	TKN (mg/g)	0.500	< 0.100	1.100	< 106.92
TOTAL P (mg/g)	0.290	0.250	0.330	62.01	Hg (ug/g)	0.030	0.020	0.030	0.01
Pb (ug/g)	46.700	22.100	78.300	9.99	Zn (ug/g)	28.700	20.600	37.400	6.14

SAMPLING DATES:

LOCATION: GODERICH , ON BASIN: HURON PROJECT BEGAN: 7907 COMPLETE: 7910 ROW= 25

PHYSICAL DATA

MATERIAL: SAND SILT CLAY DISPOSAL METHOD: BEACH NOURISHMENT- 1.6 KM SOUTH OF HARBOUR ENTRANCE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 60680 TOTAL; 72800 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.63 TOTAL $/CMPM; 4.85

REMARKS: SOME BEACH NOURISHMENT

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: LITTLE CURRENT , ON BASIN: HURON PROJECT BEGAN: 7902 COMPLETE: 7903 ROW= 21

PHYSICAL DATA

MATERIAL: ROCK, SAND, GRAVEL DISPOSAL METHOD: OPEN LAKE-+3690,LAT 455930N,LONG 815627W, LAND-^10
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 3052 TOTAL) 3700 DRY DENSITY(Kg/L)) 1.80
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 13.74 TOTAL $/CMPM) 14.73

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: PORT ELGIN , ON BASIN: HURON PROJECT BEGAN: 7809 COMPLETE: 7811 ROW= 22

PHYSICAL DATA

MATERIAL: SANDY SILT W GRAVEL DISPOSAL METHOD: LAND, NORTH OF HARBOUR
EQUIPMENT TYPE: DRAGLINE

QUANTITY(CMPM): PAY) 6533 TOTAL) 7800 DRY DENSITY(Kg/L)) 1.70
COSTS: CAPITAL CONTAINMENT) 15400 O&M CONTAINMENT) 0 DREDGING $/CMPM) 11.77 TOTAL $/CMPM) 14.82

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: SARNIA , ON BASIN: HURON PROJECT BEGAN: 7710 COMPLETE: 7804 ROW= 23

PHYSICAL DATA

MATERIAL: ORGANICS, SAND, SILT DISPOSAL METHOD: OPEN LAKE- LAT 430206N, LONG 822220W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 56524 TOTAL; 67800 DRY DENSITY(Kg/L): 1.30
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.40 TOTAL $/CMPM; 6.54

REMARKS: LONG HAUL TO OPEN LAKE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.150	0.300	5.960	1895.01	COD (mg/g)	31.600	13.400	58.900	2785.22
O&G (mg/g)	1.480	0.670	3.120	130.45	TKN (mg/g)	0.520	0.260	1.090	45.83
TOTAL P (mg/g)	0.560	0.120	1.080	49.36	Hg (ug/g)	0.080	0.030	0.190	0.01
Pb (ug/g)	48.000	20.000	91.000	4.23					

SAMPLING DATES:

LOCATION: BLACK RIVER HARBOR , MI BASIN: HURON PROJECT BEGAN: 7605 COMPLETE: 7606 ROW= 191

PHYSICAL DATA

MATERIAL: GRAVEL/SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 8900 DRY DENSITY(Kg/L): 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.47 TOTAL $/CMPM; 5.47

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.700	0.700	0.700	99.68	COD (mg/g)	2.300	2.300	2.300	32.75
O&G (mg/g)	0.060	0.060	0.060	0.85	TKN (mg/g)	0.039	0.039	0.039	0.56
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.000	Pb (ug/g)	4.000	4.000	4.000	0.06
As (ug/g)	1.200	1.200	1.200	0.02	Cd (ug/g)	< 3.000	< 3.000	< 3.000	< 0.04
Cu (ug/g)	32.000	32.000	32.000	0.46	Zn (ug/g)	38.000	38.000	38.000	0.54
Cr (ug/g)	110.000	110.000	110.000	1.57					

SAMPLING DATES: USEPA-270974

LOCATION: BLACK RIVER HARBOR , MI BASIN: HURON PROJECT BEGAN: 7710 COMPLETE: 7711 ROW= 223

PHYSICAL DATA

MATERIAL: GRAVEL/SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 5200 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 , O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.72 TOTAL $/CMPM; 7.72

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.700	0.700	0.700	58.24	COD (mg/g)	2.300	2.300	2.300	19.14
O&G (mg/g)	0.060	0.060	0.060	0.50	TKN (mg/g)	0.039	0.039	0.039	0.32
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	4.000	4.000	4.000	0.03
As (ug/g)	1.200	1.200	1.200	0.01	Cd (ug/g)	< 3.000	< 3.000	< 3.000	< 0.02
Cu (ug/g)	32.000	32.000	32.000	0.27	Zn (ug/g)	38.000	38.000	38.000	0.32
Cr (ug/g)	110.000	110.000	110.000	0.92					

SAMPLING DATES: EPA-270974

LOCATION: HARRISVILLE , MI BASIN: HURON PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 110

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 443930N, LONG 83140W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 44745 TOTAL; 44745 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.02 TOTAL $/CMPM; 4.02

REMARKS: ENTRANCE CH., HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.170	< 1.000	3.260	< 1650.64	COD (mg/g)	22.700	2.000	37.000	1726.71
O&G (mg/g)	< 0.500	< 0.500	0.500	< 38.03	TKN (mg/g)	0.954	0.063	1.600	72.57
NH3 (mg/g)	0.031	< 0.010	0.052	< 2.36	TOTAL P (mg/g)	0.160	0.045	0.250	12.17
PCB (ug/g)	< 1.000	< 1.000	< 1.000	< 0.08	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	7.000	< 5.000	11.000	< 0.53	As (ug/g)	2.000	< 2.000	2.000	< 0.15
Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.08	Cu (ug/g)	7.000	< 2.000	12.000	< 0.53
Zn (ug/g)	31.000	6.000	56.000	2.36	Cr (ug/g)	7.000	2.000	12.000	0.53
Ni (ug/g)	17.000	< 10.000	25.000	< 1.29					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-281076

LOCATION: HARRISVILLE , MI BASIN: HURON PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 111

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 443930N, LONG 8314W
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 23085 TOTAL; 23085 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.65 TOTAL $/CMPM; 3.65

REMARKS: ENTRANCE CH., HARBOR BASIN

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.170	< 1.000	3.260	< 851.61	COD (mg/g)	22.700	2.000	37.000	890.85
O&G (mg/g)	< 0.500	< 0.500	0.500	< 19.62	TKN (mg/g)	0.954	0.063	1.600	37.44
NH3 (mg/g)	< 0.031	< 0.010	0.052	< 1.22	TOTAL P (mg/g)	0.160	0.045	0.250	6.28
PCB (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00
Pb (ug/g)	7.000	< 5.000	11.000	< 0.27	As (ug/g)	2.000	< 2.000	2.000	< 0.08
Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04	Cu (ug/g)	7.000	< 2.000	12.000	< 0.27
Zn (ug/g)	31.000	6.000	56.000	1.22	Cr (ug/g)	7.000	2.000	12.000	0.27
Ni (ug/g)	17.000	< 10.000	25.000	< 0.67					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-261076

LOCATION: SAGINAW , MI BASIN: HURON PROJECT BEGAN: 7507 COMPLETE: 7509 ROW= 162

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: OPEN LAKE-LAT 434800N, LONG 834630W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 70138 TOTAL; 70138 DRY DENSITY(Kg/L); 1.50
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.52 TOTAL $/CMPM; 5.52

REMARKS: IN PTS BTWN 12.97M TO 16.65M-RIV,6TH ST TURN BASIN DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.660	3.470	6.570	5954.72	COD (mg/g)	29.300	21.000	33.000	3082.57
O&G (mg/g)	1.950	0.400	3.700	205.15	TKN (mg/g)	1.230	0.500	1.600	129.40
TOTAL P (mg/g)	0.450	0.230	0.840	47.34	PCB (ug/g)	1.700	1.000	2.200	0.18
Hg (ug/g)	0.200	< 0.200	0.200	< 0.02	Pb (ug/g)	23.000	< 10.000	40.000	< 2.42
As (ug/g)	3.000	2.000	5.000	0.32	Cd (ug/g)	5.500	3.800	7.500	0.58
Cu (ug/g)	22.000	14.000	27.000	2.31	Zn (ug/g)	150.000	70.000	220.000	15.78
Cr (ug/g)	38.000	26.000	43.000	4.00	Ni (ug/g)	123.000	50.000	160.000	12.94

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-040674/201076

LOCATION: SAGINAW , MI BASIN: HURON PROJECT BEGAN: 7710 COMPLETE: 7712 ROW= 163

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW BAY DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 81239 TOTAL; 81239 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.12 TOTAL $/CMPM; 8.12

REMARKS: IN PTS BTWN 2.82M TO 16.46M-RIVER DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.690	5.890	8.790	8152.33	COD (mg/g)	37.200	30.000	47.000	4533.14
O&G (mg/g)	3.320	0.700	7.000	404.57	TKN (mg/g)	1.740	1.400	2.400	212.03
TOTAL P (mg/g)	0.840	0.480	1.100	102.36	PCB (ug/g)	3.800	0.100	11.800	0.46
Hg (ug/g)	0.200	0.200	0.300	0.02	Pb (ug/g)	30.000	< 10.000	60.000	< 3.66
As (ug/g)	5.000	2.000	7.000	0.61	Cd (ug/g)	7.200	5.600	8.400	0.88
Cu (ug/g)	34.000	11.000	82.000	4.14	Zn (ug/g)	236.000	70.000	440.000	28.76
Cr (ug/g)	143.000	26.000	470.000	17.43	Ni (ug/g)	21.000	13.000	43.000	2.56

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-040674/201076

LOCATION: SAGINAW , MI BASIN: HURON PROJECT BEGAN: 7805 COMPLETE: 7807 ROW= 164

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW BAY CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 551608 TOTAL; 551608 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 65702 DREDGING $/CMPM; 3.02 TOTAL $/CMPM; 5.02

REMARKS: 2.8M TO 4.4M-BAY

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	12.100	11.500	12.700	100116.85	COD (mg/g)	125.000	110.000	140.000	103426.50
O&G (mg/g)	4.800	2.500	7.100	3971.58	TKN (mg/g)	1.350	1.300	1.400	1117.01
TOTAL P (mg/g)	1.170	0.840	1.500	968.07	PCB (ug/g)	1.900	1.200	4.200	1.57
Hg (ug/g)	< 0.400	< 0.400	< 0.400	< 0.33	Pb (ug/g)	35.000	20.000	50.000	28.96
As (ug/g)	5.000	< 4.000	7.000	< 4.14	Cd (ug/g)	12.700	8.400	17.000	10.51
Cu (ug/g)	22.000	8.000	36.000	18.20	Zn (ug/g)	335.000	220.000	450.000	277.18
Cr (ug/g)	86.000	80.000	91.000	71.16	Ni (ug/g)	260.000	230.000	290.000	215.13

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-030674/201076

LOCATION: SAGINAW MI BASIN: HURON PROJECT BEGAN: 7904 COMPLETE: 7908 ROW= 166

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 109827 TOTAL: 109827 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 58417 DREDGING $/CMPM: 3.83 TOTAL $/CMPM: 6.23

REMARKS: IN PTS BTWN 10.6M TO 17.63M-RIVER,6TH ST TURN BASIN DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.760	3.470	6.570	9489.05	COD (mg/g)	29.400	21.000	33.000	4843.37
O&G (mg/g)	2.080	0.400	3.700	342.66	TKN (mg/g)	1.280	0.500	1.600	210.87
TOTAL P (mg/g)	0.520	0.230	0.840	85.67	PCB (ug/g)	1.100	0.100	2.200	0.18
Hg (ug/g)	0.200	< 0.200	0.200	< 0.03	Pb (ug/g)	22.000	< 10.000	40.000	< 3.62
As (ug/g)	4.000	2.000	6.000	0.66	Cd (ug/g)	5.900	3.800	7.500	0.97
Cu (ug/g)	20.000	11.000	27.000	3.29	Zn (ug/g)	160.000	70.000	220.000	26.36
Cr (ug/g)	124.000	26.000	470.000	20.43	Ni (ug/g)	184.000	50.000	430.000	30.31

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-040674/201076

LOCATION: SAGINAW MI BASIN: HURON PROJECT BEGAN: 7808 COMPLETE: 7809 ROW= 165

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW BAY CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 75460 TOTAL: 75460 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 7.43 TOTAL $/CMPM: 9.43

REMARKS: IN PTS BTWN 0.0M TO 17.4M-RIVER DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.430	3.470	8.790	7278.12	COD (mg/g)	36.000	21.000	47.000	4074.84
O&G (mg/g)	3.100	0.400	7.000	350.89	TKN (mg/g)	1.620	0.500	2.500	183.37
TOTAL P (mg/g)	0.720	0.230	1.300	81.50	PCB (ug/g)	6.900	1.200	22.900	0.78
Hg (ug/g)	0.200	< 0.200	0.300	< 0.02	Pb (ug/g)	25.000	< 10.000	60.000	< 2.83
As (ug/g)	4.000	2.000	7.000	0.45	Cd (ug/g)	6.500	3.800	8.700	0.74
Cu (ug/g)	32.000	14.000	82.000	3.62	Zn (ug/g)	208.000	70.000	440.000	23.54
Cr (ug/g)	58.000	26.000	100.000	6.57	Ni (ug/g)	150.000	50.000	200.000	16.98

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-040674/201076

LOCATION: SAGINAW , MI BASIN: HURON PROJECT BEGAN: 7909 COMPLETE: 7910 ROW= 168

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 9586 TOTAL) 9586 DRY DENSITY(Kg/L)) 1.50
COSTS: CAPITAL CONTAINMENT) 0 . O&M CONTAINMENT) 0 DREDGING $/CMPM) 11.58 TOTAL $/CMPM) 13.98

REMARKS: IN PTS BTWN 10.6M TO 17.63M-RIV,6TH ST TURN BASIN DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.760	3.470	6.570	828.23	COD (mg/g)	29.400	21.000	33.000	422.74
O&G (mg/g)	2.080	0.400	3.700	29.91	TKN (mg/g)	1.280	0.500	1.600	18.41
TOTAL P (mg/g)	0.520	0.230	0.840	7.48	PCB (ug/g)	1.100	0.100	2.200	0.02
Hg (ug/g)	0.200	< 0.200	0.200	< 0.00	Pb (ug/g)	22.000	10.000	40.000	0.32
As (ug/g)	4.000	2.000	6.000	0.06	Cd (ug/g)	5.900	3.800	7.500	0.08
Cu (ug/g)	20.000	11.000	27.000	0.29	Zn (ug/g)	160.000	70.000	220.000	2.30
Cr (ug/g)	124.000	26.000	470.000	1.78	Ni (ug/g)	184.000	50.000	430.000	2.65

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-040674/201076

LOCATION: SAGINAW , MI BASIN: HURON PROJECT BEGAN: 7909 COMPLETE: 7910 ROW= 169

PHYSICAL DATA

MATERIAL: SAND/SILT/CLAY DISPOSAL METHOD: CONFINED-SAGINAW CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 181561 TOTAL) 181561 DRY DENSITY(Kg/L)) 1.50
COSTS: CAPITAL CONTAINMENT) 14609400 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.79 TOTAL $/CMPM) 4.19

REMARKS: IN PTS BTWN 10.6M TO 17.63M-RIV, 6TH ST TURN BASIN DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.760	3.470	6.570	15686.87	COD (mg/g)	29.400	21.000	33.000	8006.84
O&G (mg/g)	2.080	0.400	3.700	566.47	TKN (mg/g)	1.280	0.500	1.600	348.60
TOTAL P (mg/g)	0.520	0.230	0.840	141.62	PCB (ug/g)	1.100	0.100	2.200	0.30
Hg (ug/g)	0.200	< 0.200	0.200	< 0.05	Pb (ug/g)	22.000	10.000	40.000	5.99
As (ug/g)	4.000	2.000	6.000	1.09	Cd (ug/g)	5.900	3.800	7.500	1.61
Cu (ug/g)	20.000	11.000	27.000	5.45	Zn (ug/g)	160.000	70.000	220.000	43.57
Cr (ug/g)	124.000	26.000	470.000	33.77	Ni (ug/g)	184.000	50.000	430.000	50.11

OTHER PARAMETERS Ba,Co,Fe,Mn
SAMPLING DATES: EPA-050979/091079

LOCATION: SEBEWAING , MI BASIN: HURON PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 173

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 14738 TOTAL; 14738 DRY DENSITY(Kg/L) 1.50
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.30 TOTAL $/CMPM; 19.44

REMARKS: 0.21M TO 0.57M-UPSTREAM DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.300	9.460	11.200	2277.02	COD (mg/g)	126.300	120.000	140.000	2792.11
O&G (mg/g)	1.200	1.000	1.400	26.53	TKN (mg/g)	5.800	5.500	6.400	128.22
NH3 (mg/g)	0.310	0.280	0.310	6.85	TOTAL P (mg/g)	0.710	0.620	0.840	15.70
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	47.000	44.000	52.000	1.04
As (ug/g)	6.000	6.000	7.000	0.13	Cd (ug/g)	2.100	< 2.000	2.600	< 0.05
Cu (ug/g)	26.000	24.000	26.000	0.57	Zn (ug/g)	75.000	68.000	81.000	1.66
Cr (ug/g)	24.000	22.000	25.000	0.53	Ni (ug/g)	40.000	25.000	48.000	0.88

OTHER PARAMETERS Fe,Mn,Mg
SAMPLING DATES: EPA-301075

LOCATION: ST. MARYS RIVER , MI BASIN: HURON PROJECT BEGAN: 7607 COMPLETE: 7608 ROW= 190

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 462630N, LONG 8434W
EQUIPMENT TYPE: CLAM, HOPPER

QUANTITY(CMPM): PAY; 16576 TOTAL; 16576 DRY DENSITY(Kg/L) 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.330	0.400	2.400	440.92	COD (mg/g)	19.600	5.700	39.000	649.78
O&G (mg/g)	0.558	0.079	1.200	18.50	TKN (mg/g)	0.190	0.110	0.260	6.30
TOTAL P (mg/g)	0.320	0.120	0.550	10.61					

SAMPLING DATES: EPA-230572

LOCATION: ST. MARYS RIVER , MI BASIN: HURON PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 192

PHYSICAL DATA

MATERIAL: SAND/SILT
EQUIPMENT TYPE: CLAM, HOPPER

DISPOSAL METHOD: OPEN LAKE-LAT 462630N, LONG 8434W

QUANTITY(CMPM): PAY; 0 TOTAL; 0 DRY DENSITY(Kg/L): 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.330	0.400	2.400	0.00	COD (mg/g)	19.600	5.700	39.000	0.00
O&G (mg/g)	0.558	0.079	1.200	0.00	TKN (mg/g)	0.190	0.110	0.260	0.00
TOTAL P (mg/g)	0.320	0.120	0.550	0.00					

SAMPLING DATES: EPA-230572

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LOCATION: ST. MARYS RIVER , MI BASIN: HURON PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 193

PHYSICAL DATA

MATERIAL: SAND/SILT
EQUIPMENT TYPE: CLAM

DISPOSAL METHOD: OPEN LAKE-LAT 462630N, LONG 8434W

QUANTITY(CMPM): PAY; 0 TOTAL; 0 DRY DENSITY(Kg/L): 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.330	0.400	2.400	0.00	COD (mg/g)	19.600	5.700	39.000	0.00
O&G (mg/g)	0.558	0.079	1.200	0.00	TKN (mg/g)	0.190	0.110	0.260	0.00
TOTAL P (mg/g)	0.320	0.120	0.550	0.00					

SAMPLING DATES: EPA-230572

LOCATION: ST. MARYS RIVER , MI BASIN: HURON PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 195

PHYSICAL DATA

MATERIAL: SAND/SILT DISPOSAL METHOD: OPEN LAKE-LAT 462630N, LONG 8434W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 0 TOTAL; 0 DRY DENSITY(Kg/L); 2.00
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.330	0.400	2.400	0.00	COD (mg/g)	19.600	5.700	39.000	0.00
O&G (mg/g)	0.558	0.079	1.200	0.00	TKN (mg/g)	0.190	0.110	0.260	0.00
TOTAL P (mg/g)	0.320	0.120	0.550	0.00					

SAMPLING DATES: EPA-230572

LOCATION: CHENAL ECARTE , ON BASIN: ERIE PROJECT BEGAN: 7907 COMPLETE: 7912 ROW= 6

PHYSICAL DATA

MATERIAL: SILTY SAND & CLAY DISPOSAL METHOD: CONFINED, NORTH OF CHENAL ECARTE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 15066 TOTAL; 18100 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.00 TOTAL $/CMPM; 5.16

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.500	1.400	3.300	746.63	COD (mg/g)	27.000	8.000	40.000	806.36
O&G (mg/g)	0.290	0.150	0.470	8.66	TKN (mg/g)	0.330	0.070	0.530	9.86
TOTAL P (mg/g)	0.220	0.160	0.320	6.57	PCB (ug/g)	0.330	0.030	0.920	0.01
Hg (ug/g)	1.120	0.160	2.200	0.03					

OTHER PARAMETERS GRAIN SIZE,PEST.
SAMPLING DATES:

LOCATION: KINGSVILLE , ON BASIN: ERIE PROJECT BEGAN: 7710 COMPLETE: 7804 ROW= 112

PHYSICAL DATA

MATERIAL: ORGANIC SILT / SILTY SAND DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 39394 TOTAL) 39732 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 10000 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.58 TOTAL $/CMPM) 6.32

REMARKS: HARBOUR MAINTENANCE DREDGING

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.800	4.320	5.750	2669.99	COD (mg/g)	54.500	48.400	59.700	3031.55
O&G (mg/g)	3.100	2.500	3.800	172.44	TKN (mg/g)	2.230	1.990	2.550	124.04
TOTAL P (mg/g)	0.500	0.380	0.650	27.81	Hg (ug/g)	0.450	0.230	0.630	0.03

SAMPLING DATES: DPW-000077

LOCATION: KINGSVILLE , ON BASIN: ERIE PROJECT BEGAN: 7710 COMPLETE: 7804 ROW= 95

PHYSICAL DATA

MATERIAL: MIXED DISPOSAL METHOD: LAKE-4201,8242
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 0 TOTAL) 11468 DRY DENSITY(Kg/L)) 1.60
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 0.00 TOTAL $/CMPM) 0.00

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.770	1.320	2.210	324.77	COD (mg/g)	23.500	15.100	31.900	431.20
O&G (mg/g)	1.630	1.340	1.910	29.91	TKN (mg/g)	0.470	0.410	0.540	8.62
TOTAL P (mg/g)	0.350	0.260	0.440	6.42	Hg (ug/g)	0.080	0.040	0.130	0.00

SAMPLING DATES: DPW-000077

LOCATION: MITCHELL'S BAY , ON BASIN: ERIE PROJECT BEGAN: 7812 COMPLETE: 7904 ROW= 13

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: LAND- ALONG SHORE TO NORTH OF ENTRANCE CHANNEL
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 4667 TOTAL) 5780 DRY DENSITY(Kg/L)) 1.60
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 8.22 TOTAL $/CMPM) 8.65

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: PIKE CREEK , ON BASIN: ERIE PROJECT BEGAN: 7706 COMPLETE: 7709 ROW= 14

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: LAND- 4 DISPOSAL SITES IN VICINITY OF PIKE CR.
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY) 13053 TOTAL) 19600 DRY DENSITY(Kg/L)) 1.60
COSTS: CAPITAL CONTAINMENT) 28770 O&M CONTAINMENT) 1000 DREDGING $/CMPM) 9.14 TOTAL $/CMPM) 11.81

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.800	1.100	6.600	1191.68	COD (mg/g)	37.000	4.000	66.000	1160.32
O&G (mg/g)	1.100	< 0.100	5.000	< 34.50	TKN (mg/g)	0.800	0.300	1.600	25.09
TOTAL P (mg/g)	0.070	0.010	0.180	2.20	Hg (ug/g)	0.030	0.010	0.090	0.00
Pb (ug/g)	31.000	8.000	133.000	0.97					

SAMPLING DATES:

LOCATION: PORT STANLEY , ON BASIN: ERIE PROJECT BEGAN: 7500 COMPLETE: 7506 ROW= 1

PHYSICAL DATA

MATERIAL: MIXED DISPOSAL METHOD: OPEN LAKE-LAT 423830N, LONG 8140W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 48855 TOTAL; 48855 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.60 TOTAL $/CMPM; 7.34

REMARKS: MAINTENANCE DREDGING. PROJECT BEGAN 7410.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.700	2.000	5.500	2892.22	COD (mg/g)	44.000	25.000	55.000	3439.39
O&G (mg/g)	1.300	0.660	1.690	101.62	TKN (mg/g)	1.300	0.740	1.800	101.62
TOTAL P (mg/g)	0.900	0.650	1.200	70.35	Hg (ug/g)	0.103	0.090	0.114	0.01
Pb (ug/g)	64.000	34.000	83.000	5.00	Cu (ug/g)	38.000	30.000	45.000	2.97
Zn (ug/g)	99.000	47.000	161.000	7.74	Cr (ug/g)	51.000	39.000	63.000	3.99

SAMPLING DATES:

LOCATION: PORT STANLEY , ON BASIN: ERIE PROJECT BEGAN: 7710 COMPLETE: 7806 ROW= 89

PHYSICAL DATA

MATERIAL: MIXED DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 0 TOTAL; 169000 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 1019000 O&M CONTAINMENT; 70000 DREDGING $/CMPM; 3.63 TOTAL $/CMPM; 11.28

REMARKS: HARBOUR MAINTANENCE DREDGING

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.400	3.600	5.100	11897.60	TOTAL P (mg/g)	0.860	0.760	1.000	232.54
Hg (ug/g)	0.150	< 0.020	0.880	< 0.04	Pb (ug/g)	73.000	58.000	98.000	19.74
As (ug/g)	0.700	< 0.500	2.000	< 0.19	Cd (ug/g)	5.400	4.400	8.400	1.46
Cu (ug/g)	34.000	22.000	50.000	9.19	Zn (ug/g)	132.000	86.000	215.000	35.69

SAMPLING DATES: CHEMEX-000074

LOCATION: PORT STANLEY , ON BASIN: ERIE PROJECT BEGAN: 7711 COMPLETE: 7806 ROW= 78

PHYSICAL DATA

MATERIAL: MIXED DISPOSAL METHOD: BEACH-423918,811249
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 0 TOTAL; 20000 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: 36.5% SAND, 26% SILT, 37.5% CLAY. MAINTENANCE ON APPROACH.

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.300	1.200	3.100	782.00	TOTAL P (mg/g)	0.740	0.690	0.780	25.16
Hg (ug/g)	0.080	< 0.020	0.160	< 0.00	Pb (ug/g)	53.000	46.000	58.000	1.80
As (ug/g)	2.000	< 0.500	5.000	< 0.07	Cd (ug/g)	3.000	2.400	3.400	0.10
Cu (ug/g)	16.000	10.000	20.000	0.54	Zn (ug/g)	63.000	40.000	76.000	2.14

SAMPLING DATES: CHEMEX-000074

LOCATION: PUCE RIVER , ON BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7812 ROW= 15

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: LAND- CONTRACTOR'S SITE
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 10154 TOTAL; 11142 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.10 TOTAL $/CMPM; 6.50

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.310	0.670	7.950	590.08	COD (mg/g)	34.100	6.100	80.100	607.91
O&G (mg/g)	0.110	0.040	0.240	0.96	TKN (mg/g)	0.800	0.100	1.900	14.26
TOTAL P (mg/g)	0.310	0.135	0.606	5.53	Hg (ug/g)	0.053	0.017	0.110	0.00

SAMPLING DATES:

LOCATION: RUSCOM RIVER , ON BASIN: ERIE PROJECT BEGAN: 7807 COMPLETE: 7810 ROW= 16

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: LAND- 3 LOTS AT END OF BEACH DR., RUSCOM RIVER
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 17242 TOTAL; 28410 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.27 TOTAL $/CMPM; 8.14

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.500	0.670	2.960	681.84	COD (mg/g)	20.800	7.700	45.400	945.48
O&G (mg/g)	0.060	0.025	0.048	2.73	TKN (mg/g)	0.270	0.200	0.400	12.27
TOTAL P (mg/g)	0.227	0.114	0.410	10.32	Hg (ug/g)	0.025	0.015	0.036	0.00

SAMPLING DATES:

LOCATION: S.E. BEND CUTOFF , ON BASIN: ERIE PROJECT BEGAN: 7811 COMPLETE: 7909 ROW= 17

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: CONFINED- 3 CELLS ADJACENT TO SOUTH SHORE OF SEAWAY IS.
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 277020 TOTAL; 332400 DRY DENSITY(Kg/L); 1.70
COSTS: CAPITAL CONTAINMENT; 3973000 O&M CONTAINMENT; 600000 DREDGING $/CMPM; 7.15 TOTAL $/CMPM; 24.58

REMARKS: CAPITAL INCLUDES COVER, ENG. AND MISC. INCLUDES LEASE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: WHEATLEY , ON BASIN: ERIE PROJECT BEGAN: 7608 COMPLETE: 7710 ROW= 2

PHYSICAL DATA

MATERIAL: ORGANIC SILT & SAND DISPOSAL METHOD: LAND- BEHIND BERMS AT INNER END OF HARBOUR
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 45415 TOTAL) 59000 DRY DENSITY(Kg/L)) 1.30
COSTS: CAPITAL CONTAINMENT) 22397 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.39 TOTAL $/CMPM) 6.08

REMARKS: MAINTENANCE & CAPITAL

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.800	3.700	17.000	7516.60	COD (mg/g)	38.000	63.000	247.000	2914.60
TKN (mg/g)	4.600	1.400	9.000	352.82	TOTAL P (mg/g)	2.300	0.990	4.600	176.41

SAMPLING DATES:

LOCATION: BOLLES HARBOR , MI BASIN: ERIE PROJECT BEGAN: 7800 COMPLETE: 7800 ROW= 92

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY) 40187 TOTAL) 40187 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 9.78 TOTAL $/CMPM) 12.46

REMARKS: 0.17M (RIVER) TO 0.47M (RIVER)

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.550	7.500	9.600	4810.38	COD (mg/g)	150.100	68.200	232.000	8444.90
O&G (mg/g)	0.143	0.116	0.170	8.05	TKN (mg/g)	3.070	2.780	3.350	172.72
PCB (ug/g)	0.468	0.285	0.650	0.03	Pb (ug/g)	40.300	38.000	42.500	2.27
Zn (ug/g)	107.600	94.200	121.000	6.05					

SAMPLING DATES: GL BIO RES-281276

LOCATION: DETROIT RIVER CHANNELS , MI BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7912 ROW= 30

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED- PT. MOUILEE, LAT 4200N, LONG 8312W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 99014 TOTAL; 99014 DRY DENSITY(Kg/L); 1.38
COSTS: CAPITAL CONTAINMENT; 148521 O&M CONTAINMENT; 114856 DREDGING $/CMPM; 4.80 TOTAL $/CMPM; 7.46

REMARKS: LIVINGSTON CHANNEL 0.0 MILE TO 1.14 MILE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.200	1.800	8.000	7105.24	COD (mg/g)	66.700	24.000	100.000	9113.84
O&G (mg/g)	1.470	0.210	2.500	200.86	TKN (mg/g)	1.600	0.600	2.700	218.62
TOTAL P (mg/g)	0.800	0.320	1.100	109.31	Hg (ug/g)	1.200	< 1.000	1.400	< 0.16
Pb (ug/g)	96.000	11.000	165.000	13.12	As (ug/g)	7.400	7.000	7.800	1.01
Cd (ug/g)	4.400	1.100	7.000	0.60	Cu (ug/g)	22.000	11.000	< 31.000	< 3.01
Zn (ug/g)	258.000	35.000	430.000	35.25	Cr (ug/g)	101.000	11.000	169.000	13.80
Ni (ug/g)	59.000	11.000	83.000	8.06					

OTHER PARAMETERS PHENOL,Fe,Co,Mn
SAMPLING DATES: USEPA-0473/0773

LOCATION: DETROIT RIVER CHANNELS , MI BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7912 ROW= 31

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED- PT. MOUILLEE, LAT 4200N, LONG 8312W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 90485 TOTAL; 90485 DRY DENSITY(Kg/L); 1.38
COSTS: CAPITAL CONTAINMENT; 135727 O&M CONTAINMENT; 104963 DREDGING $/CMPM; 4.72 TOTAL $/CMPM; 7.38

REMARKS: EAST OUTER CHANNEL 0.0 MILE TO 1.14 MILE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.400	6.400	8.100	9240.33	COD (mg/g)	106.700	87.000	130.000	13323.55
O&G (mg/g)	4.920	2.300	8.000	614.36	TKN (mg/g)	2.200	1.800	2.700	274.71
TOTAL P (mg/g)	1.210	0.940	1.600	151.09	Hg (ug/g)	1.200	< 1.000	2.000	< 0.15
Pb (ug/g)	155.000	115.000	184.000	19.35	As (ug/g)	7.800	7.400	8.200	0.97
Cd (ug/g)	9.000	6.000	11.000	1.12	Cu (ug/g)	33.000	< 25.000	39.000	< 4.12
Zn (ug/g)	375.000	230.000	530.000	46.83	Cr (ug/g)	168.000	121.000	211.000	20.98
Ni (ug/g)	103.000	65.000	144.000	12.86					

OTHER PARAMETERS PHENOL,Fe,Co,Mn
SAMPLING DATES: USEPA-0473/0773

LOCATION: L. ERIE SAILING C. MICH & OHIO, MI   BASIN: ERIE   PROJECT BEGAN: 7607   COMPLETE: 7607   ROW= 11

PHYSICAL DATA

MATERIAL: SILT/CLAY   DISPOSAL METHOD: OPEN LAKE-LAT 4156N, LONG 8307W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 605657 TOTAL) 605657 DRY DENSITY(Kg/L)) 1.38
COSTS: CAPITAL CONTAINMENT) 0 , O&M CONTAINMENT) 0 DREDGING $/CMPM) 0.32 TOTAL $/CMPM) 0.32

REMARKS: WESTERLY 3.5 MILES

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.700	3.800	6.000	39282.91	COD (mg/g)	68.900	60.800	78.800	57587.08
O&G (mg/g)	0.550	0.250	1.010	459.69	TKN (mg/g)	2.100	1.800	2.600	1755.19
NH3 (mg/g)	0.067	0.056	0.091	56.00	TOTAL P (mg/g)	0.680	0.570	0.760	568.35
Hg (ug/g)	0.900	0.800	1.000	0.75	Pb (ug/g)	78.000	64.000	104.000	65.19
As (ug/g)	2.600	1.600	4.700	2.17	Cd (ug/g)	3.700	3.000	4.900	3.09
Cu (ug/g)	54.000	43.000	72.000	45.13	Zn (ug/g)	218.000	180.000	279.000	182.21
Cr (ug/g)	71.000	48.000	106.000	59.34	Ni (ug/g)	52.000	44.000	66.000	43.46

OTHER PARAMETERS   Mn,Ba,Mg,Fe,PAR SIZE
SAMPLING DATES: COE-270776

LOCATION: MONROE , MI   BASIN: ERIE   PROJECT BEGAN: 7610   COMPLETE: 7611   ROW= 137

PHYSICAL DATA

MATERIAL: SILT/CLAY   DISPOSAL METHOD: CONFINED-DETROIT EDISON CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 8630 TOTAL) 8630 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 201095 DREDGING $/CMPM) 14.22 TOTAL $/CMPM) 15.75

REMARKS: 0.0M TO 0.85M RIVER, 1.50M TO 1.59M RIVER

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.600	14.600	14.100	1159.87	COD (mg/g)	127.000	61.000	180.000	1534.41
O&G (mg/g)	5.500	1.100	14.000	66.45	TKN (mg/g)	3.530	1.700	6.400	42.65
NH3 (mg/g)	0.325	0.096	0.620	3.93	TOTAL P (mg/g)	1.600	1.200	2.000	19.33
Hg (ug/g)	0.200	0.100	0.300	0.00	Pb (ug/g)	73.000	25.000	120.000	0.88
As (ug/g)	10.000	9.000	11.000	0.12	Cd (ug/g)	1.900	1.200	2.300	0.02
Cu (ug/g)	538.000	54.000	1450.000	6.50	Zn (ug/g)	477.000	120.000	970.000	5.76
Cr (ug/g)	234.000	62.000	530.000	2.83	Ni (ug/g)	103.000	35.000	230.000	1.24

OTHER PARAMETERS   Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-090475

LOCATION: MONROE , MI BASIN: ERIE PROJECT BEGAN: 7704 COMPLETE: 7706 ROW= 138

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-DETROIT EDISON CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 123151 TOTAL) 123151 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 201 DREDGING $/CMPM) 2.54 TOTAL $/CMPM) 4.97

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.840	2.000	14.100	11792.94	COD (mg/g)	90.000	3.900	180.000	15517.03
O&G (mg/g)	3.140	0.800	14.000	541.37	TKN (mg/g)	2.630	0.120	6.400	453.44
NH3 (mg/g)	0.260	0.026	0.620	44.83	TOTAL P (mg/g)	0.983	0.180	2.000	169.48
Hg (ug/g)	0.300	< 0.100	0.600	< 0.05	Pb (ug/g)	67.000	6.000	120.000	11.55
As (ug/g)	8.000	3.000	12.000	1.38	Cd (ug/g)	3.000	< 1.000	7.400	< 0.52
Cu (ug/g)	223.900	8.100	1450.000	38.60	Zn (ug/g)	292.000	33.000	970.000	50.34
Cr (ug/g)	158.000	23.000	530.000	27.24	Ni (ug/g)	76.000	18.000	230.000	13.10

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-090474

LOCATION: MONROE , MI BASIN: ERIE PROJECT BEGAN: 7805 COMPLETE: 7801 ROW= 139

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM)) PAY) 70804 TOTAL) 70804 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 59197 DREDGING $/CMPM) 4.17 TOTAL $/CMPM) 5.01

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.840	2.000	14.100	6780.19	COD (mg/g)	90.000	3.900	180.000	8921.30
O&G (mg/g)	3.140	0.800	14.000	311.25	TKN (mg/g)	2.630	0.120	6.400	260.70
NH3 (mg/g)	0.260	0.026	0.620	25.77	TOTAL P (mg/g)	0.983	0.180	2.000	97.44
Hg (ug/g)	0.300	< 0.100	0.600	< 0.03	Pb (ug/g)	67.000	6.000	120.000	6.64
As (ug/g)	8.000	3.000	12.000	0.79	Cd (ug/g)	3.000	< 1.000	7.400	< 0.30
Cu (ug/g)	223.900	8.100	1450.000	22.19	Zn (ug/g)	292.000	33.000	970.000	28.94
Cr (ug/g)	158.000	23.000	530.000	15.66	Ni (ug/g)	76.000	18.000	230.000	7.53

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-090474

LOCATION: MONROE , MI BASIN: ERIE PROJECT BEGAN: 7904 COMPLETE: 7907 ROW= 141

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-DETROIT EDISON CONFINED DISPOSAL AREA
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 296437 TOTAL; 296437 DRY DENSITY(Kg/L): 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 269507 DREDGING $/CMPM; 2.05 TOTAL $/CMPM; 2.64

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.840	2.000	14.100	28386.81	COD (mg/g)	90.000	3.900	180.000	37351.06
O&G (mg/g)	3.140	0.800	14.000	1303.14	TKN (mg/g)	2.630	0.120	6.400	1091.48
NH3 (mg/g)	0.260	0.026	0.620	107.90	TOTAL P (mg/g)	0.983	0.180	2.000	407.96
Hg (ug/g)	0.300	< 0.100	0.600	< 0.12	Pb (ug/g)	67.000	6.000	120.000	27.81
As (ug/g)	8.000	3.000	12.000	3.32	Cd (ug/g)	3.000	< 1.000	7.400	< 1.25
Cu (ug/g)	223.900	8.100	1450.000	92.92	Zn (ug/g)	292.000	33.000	970.000	121.18
Cr (ug/g)	158.000	23.000	530.000	65.57	Ni (ug/g)	76.000	18.000	230.000	31.54

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-090474

LOCATION: MONROE , MI BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7812 ROW= 140

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 159584 TOTAL; 159584 DRY DENSITY(Kg/L): 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 269507 DREDGING $/CMPM; 2.43 TOTAL $/CMPM; 3.02

REMARKS: DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.840	2.000	14.100	15281.76	COD (mg/g)	90.000	3.900	180.000	20107.58
O&G (mg/g)	3.140	0.800	14.000	701.53	TKN (mg/g)	2.630	0.120	6.400	587.59
NH3 (mg/g)	0.260	0.026	0.620	58.09	TOTAL P (mg/g)	0.983	0.180	2.000	219.62
Hg (ug/g)	0.300	< 0.100	0.600	< 0.07	Pb (ug/g)	67.000	6.000	120.000	14.97
As (ug/g)	8.000	3.000	12.000	1.79	Cd (ug/g)	3.000	< 1.000	7.400	< 0.67
Cu (ug/g)	223.900	8.100	1450.000	50.02	Zn (ug/g)	292.000	33.000	970.000	65.24
Cr (ug/g)	158.000	23.000	530.000	35.30	Ni (ug/g)	76.000	18.000	230.000	16.98

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-090474

LOCATION: ROUGE RIVER , MI BASIN: ERIE PROJECT BEGAN: 7509 COMPLETE: 7511 ROW= 156

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-GRASSY ISLAND
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 75209 TOTAL; 75209 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.50 TOTAL $/CMPM; 6.27

REMARKS: IN PTS BTWN OM TO 2.70M,TURN BAS,OLD ROUGE OM TO 1.10M,DATA AVG ENT RI

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	14319.79	COD (mg/g)	210.000	34.000	310.000	22111.45
O&G (mg/g)	21.400	2.200	33.000	2253.26	TKN (mg/g)	2.200	0.820	2.900	231.64
TOTAL P (mg/g)	1.960	0.420	3.500	206.37	Pb (ug/g)	339.000	16.000	690.000	35.69
Cd (ug/g)	11.400	1.200	28.000	1.20	Cu (ug/g)	188.000	20.000	340.000	19.80
Zn (ug/g)	1197.000	53.000	2700.000	126.04	Cr (ug/g)	157.000	28.000	240.000	16.53
Ni (ug/g)	61.000	25.000	90.000	6.42					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100475

LOCATION: ROUGE RIVER , MI BASIN: ERIE PROJECT BEGAN: 7608 COMPLETE: 7609 ROW= 157

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-GRASSY ISLAND
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 75353 TOTAL; 75353 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 154370 DREDGING $/CMPM; 3.93 TOTAL $/CMPM; 10.75

REMARKS: IN PTS BTWN OM TO 2.8M,TURN BAS DRGED. DATA AVG OVER ENT RIV

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	14347.21	COD (mg/g)	210.000	34.000	310.000	22153.78
O&G (mg/g)	21.400	2.200	33.000	2257.58	TKN (mg/g)	2.200	0.820	2.900	232.09
TOTAL P (mg/g)	1.960	0.420	3.500	206.77	Pb (ug/g)	339.000	16.000	690.000	35.76
Cd (ug/g)	11.400	1.200	28.000	1.20	Cu (ug/g)	188.000	20.000	340.000	19.83
Zn (ug/g)	1197.000	53.000	2700.000	126.28	Cr (ug/g)	157.000	28.000	240.000	16.56
Ni (ug/g)	61.000	25.000	90.000	6.44					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100473

LOCATION: ROUGE RIVER , MI BASIN: ERIE PROJECT BEGAN: 7708 COMPLETE: 7709 ROW= 158

PHYSICAL DATA

MATERIAL: SILT/CLAY
EQUIPMENT TYPE: HOPPER
DISPOSAL METHOD: CONFINED-GRASSY ISLAND

QUANTITY(CMPM): PAY; 48808 TOTAL; 48808 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 32273 DREDGING $/CMPM; 5.49 TOTAL $/CMPM; 10.92

REMARKS: 0.0M TO 2.77M DRGED. DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	9293.04	COD (mg/g)	210.000	34.000	310.000	14349.55
O&G (mg/g)	21.400	2.200	33.000	1462.29	TKN (mg/g)	2.200	0.820	2.900	150.33
TOTAL P (mg/g)	1.960	0.420	3.500	133.93	Pb (ug/g)	339.000	16.000	690.000	23.16
Cd (ug/g)	11.400	1.200	28.000	0.78	Cu (ug/g)	188.000	20.000	340.000	12.85
Zn (ug/g)	1197.000	53.000	2700.000	81.79	Cr (ug/g)	157.000	28.000	240.000	10.73
Ni (ug/g)	61.000	25.000	90.000	4.17					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100473

LOCATION: ROUGE RIVER , MI BASIN: ERIE PROJECT BEGAN: 7807 COMPLETE: 7809 ROW= 159

PHYSICAL DATA

MATERIAL: SILT/CLAY
EQUIPMENT TYPE: HOPPER
DISPOSAL METHOD: CONFINED

QUANTITY(CMPM): PAY; 110713 TOTAL; 110713 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 210296 DREDGING $/CMPM; 4.71 TOTAL $/CMPM; 11.24

REMARKS: 0.0M TO 1.50M, 1.78M TO 2.80M DRGED. DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	21079.76	COD (mg/g)	210.000	34.000	310.000	32549.62
O&G (mg/g)	21.400	2.200	33.000	3316.96	TKN (mg/g)	2.200	0.820	2.900	341.00
TOTAL P (mg/g)	1.960	0.420	3.500	303.80	Pb (ug/g)	339.000	16.000	690.000	52.54
Cd (ug/g)	11.400	1.200	28.000	1.77	Cu (ug/g)	188.000	20.000	340.000	29.14
Zn (ug/g)	1197.000	53.000	2700.000	185.53	Cr (ug/g)	157.000	28.000	240.000	24.33
Ni (ug/g)	61.000	25.000	90.000	9.45					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100473

LOCATION: ROUGE RIVER , MI BASIN: ERIE PROJECT BEGAN: 7907 COMPLETE: 7909 ROW= 161

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-GRASSY ISLAND
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 89145 TOTAL; 89145 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.42 TOTAL $/CMPM; 10.19

REMARKS: 0.0M TO 0.75M, 0.99M TO 2.80M DRGED. DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	16973.21	COD (mg/g)	210.000	34.000	310.000	26208.63
O&G (mg/g)	21.400	2.200	33.000	2670.78	TKN (mg/g)	2.200	0.820	2.900	274.57
TOTAL P (mg/g)	1.960	0.420	3.500	244.61	Pb (ug/g)	339.000	16.000	690.000	42.31
Cd (ug/g)	11.400	1.200	28.000	1.42	Cu (ug/g)	188.000	20.000	340.000	23.46
Zn (ug/g)	1197.000	53.000	2700.000	149.39	Cr (ug/g)	157.000	28.000	240.000	19.59
Ni (ug/g)	61.000	25.000	90.000	7.61					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100473

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LOCATION: ROUGE RIVER MI BASIN: ERIE PROJECT BEGAN: 7809 COMPLETE: 7810 ROW= 160

PHYSICAL DATA

MATERIAL: SILT/CLAY DISPOSAL METHOD: CONFINED-GRASSY ISLAND CONFINED DISPOSAL SITE
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 9090 TOTAL; 9090 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 210296 DREDGING $/CMPM; 7.70 TOTAL $/CMPM; 14.23

REMARKS: 0.0M TO 1.50M, 1.75M TO 2.50M DRGED. DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	13.600	3.300	23.600	1730.74	COD (mg/g)	210.000	34.000	310.000	2672.46
O&G (mg/g)	21.400	2.200	33.000	272.34	TKN (mg/g)	2.200	0.820	2.900	28.00
TOTAL P (mg/g)	1.960	0.420	3.500	24.94	Pb (ug/g)	339.000	16.000	690.000	4.31
Cd (ug/g)	11.400	1.200	28.000	0.15	Cu (ug/g)	188.000	20.000	340.000	2.39
Zn (ug/g)	1197.000	53.000	2700.000	15.23	Cr (ug/g)	157.000	28.000	240.000	2.00
Ni (ug/g)	61.000	25.000	90.000	0.78					

OTHER PARAMETERS Fe,Mg,Mo,Mn,PHENOL
SAMPLING DATES: EPA-100473

LOCATION: ST. CLAIR RIVER , MI BASIN: ERIE PROJECT BEGAN: 7512 COMPLETE: 7512 ROW= 177

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 430330N, LONG 822430W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 19377 TOTAL; 19377 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.70 TOTAL $/CMPM; 3.70

REMARKS: ALGONAC 7.54M TO 7.84, PORT HURON 37.65M TO 38.24M DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	< 1.000	< 1.000	< 1.000	< 368.16	COD (mg/g)	< 1.000	< 1.000	< 1.000	< 36.82
O&G (mg/g)	0.330	< 0.250	0.400	< 12.15	TKN (mg/g)	0.026	< 0.010	0.042	< 0.96
NH3 (mg/g)	< 0.010	< 0.010	< 0.010	< 0.37	TOTAL P (mg/g)	0.060	< 0.010	0.110	< 2.21
Hg (ug/g)	0.100	< 0.100	0.100	< 0.00	Pb (ug/g)	14.000	< 10.000	18.000	< 0.52
As (ug/g)	4.000	2.000	5.000	0.15	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04
Cu (ug/g)	6.200	2.800	9.600	0.23	Zn (ug/g)	23.000	14.000	31.000	0.85
Cr (ug/g)	4.400	< 2.000	6.800	< 0.16	Ni (ug/g)	12.000	< 8.000	16.000	< 0.44

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-051075

LOCATION: ST. CLAIR RIVER , MI BASIN: ERIE PROJECT BEGAN: 7709 COMPLETE: 7710 ROW= 178

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 430330N, LONG 822430W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 18964 TOTAL; 18964 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.47 TOTAL $/CMPM; 6.47

REMARKS: ALGONAC 7.55M TO 7.94M, PORT HURON 37.65M TO 37.97M DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.000	< 1.000	1.000	< 360.32	COD (mg/g)	< 1.000	< 1.000	< 1.000	< 36.03
O&G (mg/g)	0.330	< 0.250	0.400	< 11.89	TKN (mg/g)	0.021	0.020	0.042	0.76
NH3 (mg/g)	< 0.010	< 0.010	< 0.010	< 0.36	TOTAL P (mg/g)	0.090	0.069	0.110	3.24
PCB (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04	Hg (ug/g)	0.100	< 0.100	0.100	< 0.00
Pb (ug/g)	12.000	< 5.000	18.000	< 0.43	As (ug/g)	4.000	< 2.000	5.000	< 0.14
Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.04	Cu (ug/g)	5.800	< 2.000	9.600	< 0.21
Zn (ug/g)	17.000	2.000	31.000	0.61	Cr (ug/g)	4.600	2.400	6.800	0.17
Ni (ug/g)	13.000	< 10.000	16.000	< 0.47					

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-051075/260377

LOCATION: ST. CLAIR RIVER , MI BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7811 ROW= 179

PHYSICAL DATA

MATERIAL: SAND
EQUIPMENT TYPE: HOPPER

DISPOSAL METHOD: CONFINED-*23248,OPEN LAKE-LAT 430350N,LONG 822430W+4794

QUANTITY(CMPM): PAY; 28042 TOTAL; 28042 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.93 TOTAL $/CMPM; 4.93

REMARKS: ALG.7.65 TO 8.05,ST.CLAIR 26.76 TO 27.06,PT.HURON 37.65 TO 37.99 DRGED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.030	< 1.000	1.100	< 548.78	COD (mg/g)	4.800	< 1.000	12.500	< 255.74
O&G (mg/g)	0.240	0.080	0.400	12.79	TKN (mg/g)	0.124	0.020	0.309	6.61
TOTAL P (mg/g)	0.099	0.069	0.117	5.27	Pb (ug/g)	11.000	< 5.000	18.000	< 0.59
As (ug/g)	3.000	< 2.000	5.000	< 0.16	Cd (ug/g)	7.000	< 1.000	19.000	< 0.37
Cu (ug/g)	9.900	< 2.000	18.000	< 0.53	Zn (ug/g)	27.000	2.000	49.000	1.44
Cr (ug/g)	3.100	0.200	6.800	0.17	Ni (ug/g)	14.000	< 10.000	16.000	< 0.75

SAMPLING DATES: EPA-250473/051075/260377

297

LOCATION: ST CLAIR RIVER , MI BASIN: ERIE PROJECT BEGAN: 7908 COMPLETE: 7909 ROW= 180

PHYSICAL DATA

MATERIAL: SAND
EQUIPMENT TYPE: HOPPER

DISPOSAL METHOD: CONFINED-HARSEN'S ISLAND CONFINED DISPOSAL AREA

QUANTITY(CMPM): PAY; 29785 TOTAL; 29785 DRY DENSITY(Kg/L)) 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.29 TOTAL $/CMPM; 7.29

REMARKS: ALG.7.65 TO 12.33,ST.CLAIR 26.76 TO 27.06,PT.HURON 37.65 TO 37.99

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	1.070	< 1.000	1.200	< 605.53	COD (mg/g)	4.500	< 1.000	12.500	< 254.66
O&G (mg/g)	0.240	0.080	0.400	13.58	TKN (mg/g)	0.123	0.020	0.309	6.96
TOTAL P (mg/g)	0.096	0.069	0.117	5.43	Pb (ug/g)	10.000	< 5.000	18.000	< 0.57
As (ug/g)	3.500	< 2.000	5.000	< 0.20	Cd (ug/g)	6.000	< 1.000	19.000	< 0.34
Cu (ug/g)	8.100	< 2.000	18.000	< 0.46	Zn (ug/g)	45.000	2.000	100.000	2.55
Cr (ug/g)	3.500	0.200	6.800	0.20	Ni (ug/g)	16.000	< 10.000	20.000	< 0.91

SAMPLING DATES: EPA-051075/250473/260377

LOCATION: BLACK ROCK , NY BASIN: ERIE PROJECT BEGAN: 7508 COMPLETE: 7508 ROW= 233

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 1095 TOTAL; 1095 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.20 TOTAL $/CMPM; 5.32

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.260	3.700	18.300	141.96	COD (mg/g)	117.000	37.000	183.000	179.36
O&G (mg/g)	33.100	1.500	78.100	50.74	TKN (mg/g)	4.070	1.000	8.480	6.24
Pb (ug/g)	14.600	7.300	26.000	0.02	Zn (ug/g)	28.400	8.800	48.400	0.04

SAMPLING DATES: EPA-190772

298

LOCATION: BLACK ROCK CHANNEL & TONAWANDA, NY BASIN: ERIE PROJECT BEGAN: 7809 COMPLETE: 7810 ROW= 287

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 7952 TOTAL; 8869 DRY DENSITY(Kg/L); 1.29
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 10.27 TOTAL $/CMPM; 13.47

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	12.100	5.800	18.300	1388.65	COD (mg/g)	157.000	131.000	183.000	1801.81
O&G (mg/g)	48.900	19.800	78.100	561.20	TKN (mg/g)	5.600	2.730	8.480	64.27
Pb (ug/g)	18.200	10.400	26.000	0.21	Zn (ug/g)	38.300	28.100	48.400	0.44

SAMPLING DATES: EPA-190772

LOCATION: BLACK ROCK CHANNEL & TONAWANDA, NY   BASIN: ERIE   PROJECT BEGAN: 7908   COMPLETE: 7009   ROW= 295

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 20262 TOTAL: 20262 DRY DENSITY(Kg/L): 1.27
COSTS: CAPITAL CONTAINMENT: 3 O&M CONTAINMENT: 0 DREDGING $/CMPM: 3.41 TOTAL $/CMPM: 6.61

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	12.100	5.800	18.300	3116.11	COD (mg/g)	157.000	131.000	183.000	4043.22
O&G (mg/g)	48.900	19.800	78.100	1259.32	TKN (mg/g)	5.600	2.730	8.480	144.22
Pb (ug/g)	18.200	10.400	26.000	0.47	Zn (ug/g)	38.300	28.100	48.400	0.99

SAMPLING DATES: EPA-190772

LOCATION: BLACK ROCK CHANNEL & TONAWANDA, NY   BASIN: ERIE   PROJECT BEGAN: 7910   COMPLETE: 7910   ROW= 299

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 459 TOTAL: 459 DRY DENSITY(Kg/L): 1.27
COSTS: CAPITAL CONTAINMENT: 3 O&M CONTAINMENT: 0 DREDGING $/CMPM: 3.14 TOTAL $/CMPM: 6.34

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	12.100	5.800	18.300	70.59	COD (mg/g)	157.000	131.000	183.000	91.59
O&G (mg/g)	48.900	19.800	78.100	28.53	TKN (mg/g)	5.600	2.730	8.480	3.27
Pb (ug/g)	18.200	10.400	26.000	0.01	Zn (ug/g)	38.300	28.100	48.400	0.02

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7506 COMPLETE: 7508 ROW= 231

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 104091 TOTAL; 133626 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.39 TOTAL $/CMPM; 6.51

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.230	0.530	5.300	7918.98	COD (mg/g)	52.900	1.400	75.000	9903.41
O&G (mg/g)	3.900	0.770	10.000	730.12	TKN (mg/g)	1.710	0.260	2.520	320.13
Pb (ug/g)	9.600	3.300	21.000	1.80	Zn (ug/g)	24.700	9.800	32.900	4.62

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7604 COMPLETE: 7609 ROW= 248

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 105250 TOTAL; 173664 DRY DENSITY(Kg/L); 1.42
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 10.13 TOTAL $/CMPM; 10.13

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.220	0.530	5.300	10377.33	COD (mg/g)	48.700	1.400	75.000	11975.73
O&G (mg/g)	3.440	77.000	10.000	845.92	TKN (mg/g)	1.630	0.260	2.520	400.83
Pb (ug/g)	8.700	3.300	21.000	2.14	Zn (ug/g)	23.800	9.800	32.900	5.85

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO RIVER , NY BASIN: ERIE PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 276

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 205681 TOTAL) 205681 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 1 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.09 TOTAL $/CMPM) 5.60

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.230	0.530	5.300	12180.43	COD (mg/g)	52.900	1.400	75.000	15232.73
O&G (mg/g)	3.900	0.770	10.000	1123.02	TKN (mg/g)	1.710	0.260	2.520	492.40
Pb (ug/g)	9.600	3.300	21.000	2.76	Zn (ug/g)	24.700	9.800	32.900	7.11

SAMPLING DATES: EPA-190772

301

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7812 ROW= 288

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 183839 TOTAL) 183839 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 3 O&M CONTAINMENT) 0 DREDGING $/CMPM) 3.23 TOTAL $/CMPM) 6.43

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.220	0.530	5.300	10861.21	COD (mg/g)	48.700	1.400	75.000	12534.14
O&G (mg/g)	3.440	0.770	10.000	885.37	TKN (mg/g)	1.630	0.260	2.520	419.52
Pb (ug/g)	8.700	3.300	21.000	2.24	Zn (ug/g)	23.800	9.800	32.900	6.13

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7908 COMPLETE: 7909 ROW= 296

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 69995 TOTAL) 69995 DRY DENSITY(Kg/L)) 1.39
COSTS: CAPITAL CONTAINMENT) 3 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.02 TOTAL $/CMPM) 5.22

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.220	0.530	5.300	4108.72	COD (mg/g)	48.700	1.400	75.000	4741.58
O&G (mg/g)	3.440	0.770	10.000	334.93	TKN (mg/g)	1.630	0.260	2.520	158.70
Pb (ug/g)	8.700	3.300	21.000	0.85	Zn (ug/g)	23.800	9.800	32.900	2.32

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7700 COMPLETE: 7700 ROW= 277

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 154048 TOTAL) 154048 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 1 O&M CONTAINMENT) 0 DREDGING $/CMPM) 4.24 TOTAL $/CMPM) 4.75

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.100	3.000	5.100	8842.36	COD (mg/g)	49.800	32.000	64.000	10740.23
O&G (mg/g)	3.100	1.600	4.000	668.57	TKN (mg/g)	1.420	1.080	1.650	306.25
Pb (ug/g)	6.900	4.900	11.600	1.49	Zn (ug/g)	22.300	19.000	26.200	4.81

SAMPLING DATES: EPA-190772

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7909 COMPLETE: 7909 ROW= 297

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 18090 TOTAL: 18090 DRY DENSITY(Kg/L): 1.53
COSTS: CAPITAL CONTAINMENT: 3 O&M CONTAINMENT: 0 DREDGING $/CMPM: 6.13 TOTAL $/CMPM: 9.33

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.220	0.530	5.300	1168.00	COD (mg/g)	48.700	1.400	75.000	1347.90
O&G (mg/g)	3.440	0.770	10.000	95.21	TKN (mg/g)	1.630	0.260	2.520	45.11
Pb (ug/g)	8.700	3.300	21.000	0.24	Zn (ug/g)	23.800	9.800	32.900	0.66

SAMPLING DATES: EPA-190772

303

LOCATION: BUFFALO HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7911 ROW= 298

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 3981 TOTAL: 3981 DRY DENSITY(Kg/L): 1.43
COSTS: CAPITAL CONTAINMENT: 3 O&M CONTAINMENT: 0 DREDGING $/CMPM: 5.13 TOTAL $/CMPM: 8.33

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.220	0.530	5.300	239.90	COD (mg/g)	48.700	1.400	75.000	276.85
O&G (mg/g)	3.440	0.770	10.000	19.56	TKN (mg/g)	1.630	0.260	2.520	9.27
Pb (ug/g)	8.700	3.300	21.000	0.05	Zn (ug/g)	23.800	9.800	32.900	0.14

SAMPLING DATES: EPA-190772

LOCATION: DUNKIRK HARBOR , NY BASIN: ERIE PROJECT BEGAN: 7506 COMPLETE: 7508 ROW= 232

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 17059 TOTAL; 14233 DRY DENSITY(Kg/L); 1.65
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.35 TOTAL $/CMPM; 9.47

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.700	5.500	5.900	1334.56	COD (mg/g)	174.000	166.000	182.000	4073.91
O&G (mg/g)	1.940	1.920	1.950	45.42	TKN (mg/g)	0.798	0.771	0.824	18.68
Hg (ug/g)	0.100	< 0.100	0.100	< 0.00	Pb (ug/g)	50.000	38.000	62.000	1.17
Zn (ug/g)	134.000	127.000	141.000	3.14					

SAMPLING DATES: EPA-190375

304

LOCATION: ASHTABULA HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7508 COMPLETE: 7508 ROW= 243

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 198360 TOTAL; 223156 DRY DENSITY(Kg/L); 1.49
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.64 TOTAL $/CMPM; 0.64

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.940	3.780	6.210	16381.52	COD (mg/g)	30.000	38.000	61.000	9948.29
O&G (mg/g)	2.100	1.100	3.100	696.38	TKN (mg/g)	1.530	1.200	1.800	507.36
TOTAL P (mg/g)	0.660	0.480	0.930	218.86	Hg (ug/g)	1.200	0.100	3.200	0.40
Pb (ug/g)	16.000	< 10.000	22.000	< 5.31	As (ug/g)	9.000	7.000	11.000	2.98
Cd (ug/g)	8.000	< 1.000	12.000	< 2.65	Cu (ug/g)	30.000	25.000	35.000	9.95
Zn (ug/g)	169.000	150.000	200.000	56.04	Cr (ug/g)	74.000	48.000	110.000	24.54
Ni (ug/g)	115.000	25.000	160.000	38.14					

OTHER PARAMETERS Ba,Fe,Mn
SAMPLING DATES: EPA-030674/200275

LOCATION: ASHTABULA HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7605 COMPLETE: 7606 ROW= 251

PHYSICAL DATA

MATERIAL: DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 96689 TOTAL; 98717 DRY DENSITY(Kg/L); 1.50

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.26 TOTAL $/CMPM; 1.26

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.530	4.840	6.210	8188.58	COD (mg/g)	56.000	51.000	61.000	8292.23
O&G (mg/g)	2.600	2.100	3.100	385.00	TKN (mg/g)	1.400	1.200	1.600	207.31
TOTAL P (mg/g)	0.520	0.480	0.560	77.00	Hg (ug/g)	1.800	0.400	3.200	0.27
Pb (ug/g)	< 13.000	< 10.000	< 15.000	< 1.92	As (ug/g)	8.000	7.000	9.000	1.18
Cd (ug/g)	12.000	10.000	12.000	1.78	Cu (ug/g)	27.000	25.000	30.000	4.00
Zn (ug/g)	175.000	150.000	200.000	25.91	Cr (ug/g)	87.000	63.000	110.000	12.88
Ni (ug/g)	160.000	160.000	160.000	23.69					

OTHER PARAMETERS Ba,Co,Fe,Mn

SAMPLING DATES:

LOCATION: ASHTABULA HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7704 COMPLETE: 7705 ROW= 261

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 18016 TOTAL; 33912 DRY DENSITY(Kg/L); 1.58

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 16.48 TOTAL $/CMPM; 16.48

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.840	4.840	4.840	2585.11	COD (mg/g)	61.000	61.000	61.000	3258.10
O&G (mg/g)	2.100	2.100	2.100	112.16	TKN (mg/g)	1.200	1.200	1.200	64.09
TOTAL P (mg/g)	0.480	0.480	0.480	25.64	Hg (ug/g)	0.400	0.400	0.400	0.02
Pb (ug/g)	< 10.000	< 10.000	< 10.000	< 0.53	As (ug/g)	9.000	9.000	9.000	0.48
Cd (ug/g)	12.000	12.000	12.000	0.64	Cu (ug/g)	30.000	30.000	30.000	1.60
Zn (ug/g)	150.000	150.000	150.000	8.01	Cr (ug/g)	63.000	63.000	63.000	3.36
Ni (ug/g)	160.000	160.000	160.000	8.55					

OTHER PARAMETERS Ba,Co,Fe,Mn

SAMPLING DATES: EPA-030674

LOCATION: ASHTABULA HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7805 COMPLETE: 7806 ROW= 280

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 26318 TOTAL) 38750 DRY DENSITY(Kg/L)) 1.52
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 4.46 TOTAL $/CMPM) 4.46

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.310	4.280	6.460	3135.82	COD (mg/g)	73.800	58.000	94.000	4358.26
O&G (mg/g)	0.730	< 0.600	0.900	< 43.11	TKN (mg/g)	1.450	0.990	1.750	85.63
NH3 (mg/g)	0.087	0.046	0.115	5.14	TOTAL P (mg/g)	0.690	0.320	1.100	40.75
PCB (ug/g)	6.120	3.760	7.310	0.36	Hg (ug/g)	0.700	0.300	1.700	0.04
Pb (ug/g)	66.000	49.000	79.000	3.90	As (ug/g)	12.000	10.000	14.000	0.71
Cd (ug/g)	4.000	3.000	5.000	0.24	Cu (ug/g)	31.000	30.000	33.000	1.83
Zn (ug/g)	174.000	154.000	204.000	10.28	Cr (ug/g)	121.000	55.000	182.000	7.15
Ni (ug/g)	53.000	44.000	66.000	3.13					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-220677

LOCATION: ASHTABULA HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7908 COMPLETE: 7908 ROW= 308

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 12696 TOTAL) 12696 DRY DENSITY(Kg/L)) 1.53
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 7.71 TOTAL $/CMPM) 7.71

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.950	5.950	5.950	1152.00	COD (mg/g)	91.000	91.000	91.000	1761.89
O&G (mg/g)	1.500	1.500	1.500	29.04	TKN (mg/g)	1.900	1.900	1.900	36.79
NH3 (mg/g)	0.130	0.130	0.130	2.52	TOTAL P (mg/g)	0.670	0.670	0.670	12.97
PCB (ug/g)	2.430	2.430	2.430	0.05	Hg (ug/g)	0.900	0.900	0.900	0.02
Pb (ug/g)	74.000	74.000	74.000	1.43	As (ug/g)	11.000	11.000	11.000	0.21
Cd (ug/g)	5.000	5.000	5.000	0.10	Cu (ug/g)	32.000	32.000	32.000	0.62
Zn (ug/g)	169.000	169.000	169.000	3.27	Cr (ug/g)	42.000	42.000	42.000	0.81
Ni (ug/g)	37.000	37.000	37.000	0.72					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-220677

LOCATION: ASHTABULA HARBOR , OH   BASIN: ERIE   PROJECT BEGAN: 7700   COMPLETE: 7700   ROW= 278

PHYSICAL DATA

MATERIAL: SILT/ROCK   DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY; 64373 TOTAL; 64373 DRY DENSITY(Kg/L): 1.58
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.54 TOTAL $/CMPM; 6.54

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.970	2.800	3.140	3011.21	COD (mg/g)	41.000	40.000	42.000	4156.89
O&G (mg/g)	< 0.600	< 0.600	< 0.600	< 60.83	TKN (mg/g)	1.070	0.940	1.200	108.48
NH3 (mg/g)	0.075	0.060	0.091	7.60	TOTAL P (mg/g)	0.420	0.500	0.340	42.58
PCB (ug/g)	2.260	1.320	3.200	0.23	Hg (ug/g)	0.300	0.200	0.300	0.03
Pb (ug/g)	47.000	37.000	57.000	4.77	As (ug/g)	13.000	9.000	17.000	1.32
Cd (ug/g)	3.000	< 2.000	4.000	< 0.30	Cu (ug/g)	29.000	23.000	35.000	2.94
Zn (ug/g)	168.000	164.000	172.000	17.03	Cr (ug/g)	43.000	33.000	53.000	4.36
Ni (ug/g)	38.000	32.000	44.000	3.85					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-220677

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7503   COMPLETE: 7507   ROW= 238

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 259274 TOTAL; 259274 DRY DENSITY(Kg/L): 1.45
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.96 TOTAL $/CMPM; 9.12

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.120	5.300	16.500	30421.66	COD (mg/g)	106.900	80.000	170.000	40050.18
O&G (mg/g)	5.670	3.500	14.000	2124.27	TKN (mg/g)	2.130	1.300	3.400	798.01
NH3 (mg/g)	0.274	0.049	0.590	102.65	TOTAL P (mg/g)	2.090	1.500	3.800	783.02
PCB (ug/g)	1.563	0.290	2.196	0.59	Hg (ug/g)	0.200	< 0.100	0.600	< 0.07
Pb (ug/g)	197.000	66.000	330.000	73.81	As (ug/g)	35.000	17.000	46.000	13.11
Cd (ug/g)	14.000	1.000	46.000	5.25	Cu (ug/g)	114.000	42.000	180.000	42.71
Zn (ug/g)	1263.000	200.000	11000.000	473.18	Cr (ug/g)	109.000	45.000	240.000	40.84
Ni (ug/g)	72.000	29.000	110.000	26.97					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-250877/031177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH BASIN: ERIE PROJECT BEGAN: 7611 COMPLETE: 7612 ROW= 255

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 26914 TOTAL) 32113 DRY DENSITY(Kg/L)) 1.37
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 5.94 TOTAL $/CMPM) 5.94

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.380	2.300	6.460	1932.60	COD (mg/g)	58.500	17.000	100.000	2581.21
O&G (mg/g)	3.520	< 0.600	6.450	< 155.31	TKN (mg/g)	1.340	0.370	2.300	59.13
NH3 (mg/g)	0.171	0.032	0.310	7.55	TOTAL P (mg/g)	1.230	0.046	2.000	54.27
PCB (ug/g)	0.768	0.010	1.526	0.03	Hg (ug/g)	0.200	< 0.100	0.200	< 0.01
Pb (ug/g)	94.000	7.000	180.000	4.15	As (ug/g)	19.000	16.000	23.000	0.84
Cd (ug/g)	8.000	< 0.200	15.000	< 0.35	Cu (ug/g)	73.000	21.000	125.000	3.22
Zn (ug/g)	285.000	59.000	510.000	12.58	Cr (ug/g)	67.000	14.000	120.000	2.96
Ni (ug/g)	43.000	15.000	71.000	1.90					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240877/071177

308

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH BASIN: ERIE PROJECT BEGAN: 7703 COMPLETE: 7704 ROW= 266

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 38306 TOTAL) 45723 DRY DENSITY(Kg/L)) 1.45
COSTS: CAPITAL CONTAINMENT) 3 O&M CONTAINMENT) 0 DREDGING $/CMPM) 4.62 TOTAL $/CMPM) 7.78

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.380	2.300	6.460	2905.87	COD (mg/g)	58.500	17.000	100.000	3881.13
O&G (mg/g)	3.520	< 0.600	6.450	< 233.53	TKN (mg/g)	1.340	0.370	2.300	88.90
NH3 (mg/g)	0.171	0.032	0.310	11.34	TOTAL P (mg/g)	1.230	0.046	2.000	81.60
PCB (ug/g)	0.768	0.010	1.526	0.05	Hg (ug/g)	0.200	< 0.100	0.200	< 0.01
Pb (ug/g)	94.000	7.000	180.000	6.24	As (ug/g)	19.000	16.000	23.000	1.26
Cd (ug/g)	8.000	< 0.200	15.000	< 0.53	Cu (ug/g)	73.000	21.000	125.000	4.84
Zn (ug/g)	285.000	59.000	510.000	18.91	Cr (ug/g)	67.000	14.000	120.000	4.45
Ni (ug/g)	43.000	15.000	71.000	2.85					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240877/071177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7804   COMPLETE: 7805   ROW= 279

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 99161 TOTAL; 101355 DRY DENSITY(Kg/L): 1.43
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.19 TOTAL $/CMPM; 6.35

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.380	2.300	6.460	6348.27	COD (mg/g)	58.500	17.000	100.000	8478.85
O&G (mg/g)	3.520	< 0.600	6.450	< 510.18	TKN (mg/g)	1.340	0.370	2.300	194.22
NH3 (mg/g)	0.171	0.032	0.310	24.78	TOTAL P (mg/g)	1.230	0.046	2.000	178.27
PCB (ug/g)	0.768	0.010	1.526	0.11	Hg (ug/g)	0.200	< 0.100	0.200	< 0.03
Pb (ug/g)	94.000	7.000	180.000	13.62	As (ug/g)	19.000	16.000	23.000	2.75
Cd (ug/g)	8.000	< 0.200	15.000	< 1.16	Cu (ug/g)	73.000	21.000	125.000	10.58
Zn (ug/g)	285.000	59.000	510.000	41.31	Cr (ug/g)	67.000	14.000	120.000	9.71
Ni (ug/g)	43.000	15.000	71.000	6.23					

OTHER PARAMETERS Fe,Mn,Mg,PEST SCAN
SAMPLING DATES: EPA-250877/071177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7903   COMPLETE: 7904   ROW= 290

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 42053 TOTAL; 47252 DRY DENSITY(Kg/L): 1.44
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.02 TOTAL $/CMPM; 8.18

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.380	2.300	6.460	2969.93	COD (mg/g)	58.500	17.000	100.000	3966.69
O&G (mg/g)	3.520	< 0.600	6.450	< 238.68	TKN (mg/g)	1.340	0.370	2.300	90.86
NH3 (mg/g)	0.171	0.032	0.310	11.59	TOTAL P (mg/g)	1.230	0.046	2.000	83.40
PCB (ug/g)	0.768	0.010	1.526	0.05	Hg (ug/g)	0.200	< 0.100	0.200	< 0.01
Pb (ug/g)	94.000	7.000	180.000	6.37	As (ug/g)	19.000	16.000	23.000	1.29
Cd (ug/g)	8.000	< 0.200	15.000	< 0.54	Cu (ug/g)	73.000	21.000	125.000	4.95
Zn (ug/g)	285.000	59.000	510.000	19.32	Cr (ug/g)	67.000	14.000	120.000	4.54
Ni (ug/g)	43.000	15.000	71.000	2.92					

OTHER PARAMETERS Fe,Mn,Mg,PEST SCAN
SAMPLING DATES: EPA-250877/071177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7512   COMPLETE: 7512   ROW= 244

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM):   PAY) 41288   TOTAL) 49699   DRY DENSITY(Kg/L)) 1.47
COSTS: CAPITAL CONTAINMENT) 3   O&M CONTAINMENT) 0   DREDGING $/CMPM) 2.21   TOTAL $/CMPM) 5.37

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.380	2.300	6.460	3189.04	COD (mg/g)	58.500	17.000	100.000	4259.33
O&G (mg/g)	3.520	< 0.600	6.450	< 256.29	TKN (mg/g)	1.340	0.370	2.300	97.56
NH3 (mg/g)	0.171	0.032	0.310	12.45	TOTAL P (mg/g)	1.230	0.046	2.000	89.56
PCB (ug/g)	0.768	0.010	1.526	0.06	Hg (ug/g)	0.200	< 0.100	0.200	< 0.01
Pb (ug/g)	94.000	7.000	180.000	6.84	As (ug/g)	19.000	16.000	23.000	1.38
Cd (ug/g)	8.000	< 0.200	15.000	< 0.58	Cu (ug/g)	73.000	31.000	125.000	5.32
Zn (ug/g)	285.000	59.000	510.000	20.75	Cr (ug/g)	67.000	14.000	120.000	4.88
Ni (ug/g)	43.000	15.000	71.000	3.13					

OTHER PARAMETERS   Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240877/071177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7510   COMPLETE: 7606   ROW= 260

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM):   PAY) 469177   TOTAL) 469177   DRY DENSITY(Kg/L)) 1.45
COSTS: CAPITAL CONTAINMENT) 3   O&M CONTAINMENT) 0   DREDGING $/CMPM) 5.85   TOTAL $/CMPM) 9.01

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.120	5.300	16.500	55050.41	COD (mg/g)	106.900	80.000	170.000	72474.01
O&G (mg/g)	5.670	3.500	14.500	3844.04	TKN (mg/g)	2.130	1.300	3.400	1444.06
NH3 (mg/g)	0.274	0.049	0.590	185.76	TOTAL P (mg/g)	2.090	1.500	3.800	1416.94
PCB (ug/g)	1.563	0.290	2.196	1.06	Hg (ug/g)	0.200	< 0.100	0.600	< 0.14
Pb (ug/g)	197.000	66.000	330.000	133.56	As (ug/g)	35.000	17.000	46.000	23.73
Cd (ug/g)	14.000	1.000	46.000	9.49	Cu (ug/g)	114.000	42.000	180.000	77.29
Zn (ug/g)	1263.000	200.000	11000.000	856.26	Cr (ug/g)	109.000	45.000	240.000	73.90
Ni (ug/g)	72.000	29.000	110.000	48.81					

OTHER PARAMETERS   Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-250877/031177

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7810   COMPLETE: 7908   ROW= 208

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED/#12
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 478879 TOTAL; 478879 DRY DENSITY(Kg/L); 1.45
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.70 TOTAL $/CMPM; 8.86

REMARKS: ENTIRE RIVER

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.120	5.300	16.500	56188.79	COD (mg/g)	106.900	80.000	170.000	73972.68
O&G (mg/g)	5.670	3.500	14.000	3923.53	TKN (mg/g)	2.130	1.300	3.400	1473.92
NH3 (mg/g)	0.274	0.049	0.590	189.60	TOTAL P (mg/g)	2.090	1.500	3.800	1446.24
PCB (ug/g)	1.563	0.290	2.196	1.08	Hg (ug/g)	0.200	< 0.100	0.600	< 0.14
Pb (ug/g)	197.000	66.000	330.000	136.32	As (ug/g)	35.000	17.000	46.000	24.22
Cd (ug/g)	14.000	1.000	46.000	9.69	Cu (ug/g)	114.000	42.000	180.000	78.89
Zn (ug/g)	1263.000	200.000	11000.000	873.97	Cr (ug/g)	109.000	45.000	240.000	75.43
Ni (ug/g)	72.000	29.000	110.000	49.82					

OTHER PARAMETERS Fe,Mn,Mg,PEST
SAMPLING DATES: EPA-250877/031177

312

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH   BASIN: ERIE   PROJECT BEGAN: 7708   COMPLETE: 7711   ROW= 194

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: CONFINED/#12
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 103644 TOTAL; 103644 DRY DENSITY(Kg/L); 1.45
COSTS: CAPITAL CONTAINMENT; 316 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.47 TOTAL $/CMPM; 8.63

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.960	7.030	9.310	11921.34	COD (mg/g)	112.300	97.000	130.000	16818.67
O&G (mg/g)	6.770	3.900	11.000	1013.91	TKN (mg/g)	2.770	2.300	3.300	414.85
NH3 (mg/g)	0.443	0.350	0.590	66.35	TOTAL P (mg/g)	2.630	2.000	3.800	393.88
PCB (ug/g)	1.734	1.048	2.185	0.26	Hg (ug/g)	0.100	< 0.100	0.200	< 0.01
Pb (ug/g)	250.000	200.000	310.000	37.44	As (ug/g)	39.000	36.000	43.000	5.84
Cd (ug/g)	27.000	14.000	46.000	4.04	Cu (ug/g)	122.000	95.000	170.000	18.27
Zn (ug/g)	573.000	480.000	690.000	85.82	Cr (ug/g)	156.000	98.000	240.000	23.36
Ni (ug/g)	80.000	57.000	110.000	11.98					

OTHER PARAMETERS Fe,Mn,Mg,PEST.
SAMPLING DATES: USEPA-250877

LOCATION: CUYAHOGA RIVER & CLEVELAND HBR, OH BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7911 ROW= 312

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 124741 TOTAL) 124741 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT) 7 O&M CONTAINMENT) 0 DREDGING $/CMPM) 9.33 TOTAL $/CMPM) 15.95

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.960	7.030	9.310	13901.14	COD (mg/g)	112.300	97.000	130.000	19611.78
O&G (mg/g)	6.770	3.900	11.000	1182.30	TKN (mg/g)	2.770	2.300	3.300	483.75
NH3 (mg/g)	0.443	0.350	0.590	77.36	TOTAL P (mg/g)	2.630	2.000	3.800	459.30
PCB (ug/g)	1.734	1.048	2.185	0.30	Hg (ug/g)	0.100	< 0.100	0.200	< 0.02
Pb (ug/g)	250.000	200.000	3.100	43.66	As (ug/g)	39.000	36.000	43.000	6.81
Cd (ug/g)	27.000	14.000	46.000	4.72	Cu (ug/g)	122.000	95.000	170.000	21.31
Zn (ug/g)	573.000	480.000	690.000	100.07	Cr (ug/g)	156.000	98.000	240.000	27.24
Ni (ug/g)	80.000	57.000	110.000	13.97					

OTHER PARAMETERS Fe,Mn,Mg, PEST. SCAN
SAMPLING DATES: EPA-250877/031177

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7510 COMPLETE: 7511 ROW= 235

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 97961 TOTAL) 97961 DRY DENSITY(Kg/L)) 1.44
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.54 TOTAL $/CMPM) 1.54

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.690	3.390	4.270	5216.10	COD (mg/g)	46.000	43.000	52.000	6502.46
O&G (mg/g)	0.610	0.350	0.940	86.23	TKN (mg/g)	0.880	0.770	1.100	124.39
TOTAL P (mg/g)	0.520	0.460	0.640	73.51	Hg (ug/g)	0.400	< 0.200	0.700	< 0.06
Pb (ug/g)	22.000	< 10.000	45.000	< 3.11	As (ug/g)	8.000	7.000	9.000	1.13
Cd (ug/g)	4.100	1.900	5.400	0.58	Cu (ug/g)	38.000	26.000	54.000	5.37
Zn (ug/g)	210.000	100.000	410.000	29.69	Cr (ug/g)	32.000	23.000	41.000	4.52
Ni (ug/g)	133.000	110.000	150.000	18.80					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-040674

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7604 COMPLETE: 7605 ROW= 250

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 46827 TOTAL) 63777 DRY DENSITY(Kg/L)) 1.57
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.60 TOTAL $/CMPM) 1.60

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.360	3.710	5.440	4362.88	COD (mg/g)	49.000	41.000	60.000	4903.24
O&G (mg/g)	0.610	0.360	0.850	61.04	TKN (mg/g)	1.070	0.810	1.600	107.07
TOTAL P (mg/g)	0.500	0.470	0.510	50.03	Hg (ug/g)	0.200	< 0.200	0.200	< 0.02
Pb (ug/g)	21.000	< 10.000	50.000	< 2.10	As (ug/g)	9.000	2.000	15.000	0.90
Cd (ug/g)	6.200	5.200	7.000	0.62	Cu (ug/g)	22.000	15.000	26.000	2.20
Zn (ug/g)	130.000	120.000	140.000	13.01	Cr (ug/g)	41.000	36.000	49.000	4.10
Ni (ug/g)	198.000	160.000	270.000	19.81					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: EPA-030674

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7703 COMPLETE: 7704 ROW= 213

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 56886 TOTAL) 60403 DRY DENSITY(Kg/L)) 1.58
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.69 TOTAL $/CMPM) 1.69

REMARKS: WEST OUTER HARBOR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.120	3.390	5.440	3934.48	COD (mg/g)	49.500	43.000	60.000	4727.11
O&G (mg/g)	0.610	0.350	0.940	58.25	TKN (mg/g)	1.060	0.770	1.600	101.23
TOTAL P (mg/g)	0.510	0.460	0.640	48.70	Hg (ug/g)	0.400	< 0.200	0.700	< 0.04
Pb (ug/g)	29.000	< 10.000	50.000	< 2.77	As (ug/g)	9.000	7.000	12.000	0.86
Cd (ug/g)	4.800	1.900	6.700	0.46	Cu (ug/g)	35.000	25.000	54.000	3.34
Zn (ug/g)	190.000	100.000	410.000	18.14	Cr (ug/g)	34.000	23.000	41.000	3.25
Ni (ug/g)	167.000	110.000	270.000	15.95					

OTHER PARAMETERS Ba,Co,Fe,Mn,Mg
SAMPLING DATES: USEPA-030674

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7806 COMPLETE: 7806 ROW= 285

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 20944 TOTAL; 21715 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.45 TOTAL $/CMPM; 3.45

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.550	< 1.000	4.400	< 883.76	COD (mg/g)	40.000	10.000	65.000	1386.29
O&G (mg/g)	< 0.600	< 0.600	< 0.600	< 20.79	TKN (mg/g)	0.850	0.200	1.300	29.46
NH3 (mg/g)	0.048	< 0.010	0.075	< 1.66	TOTAL P (mg/g)	0.480	0.270	0.580	16.64
PCB (ug/g)	0.069	0.032	0.094	0.00	Hg (ug/g)	0.100	< 0.100	0.100	< 0.00
Pb (ug/g)	32.000	15.000	45.000	1.11	As (ug/g)	11.000	8.000	12.000	0.38
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.07	Cu (ug/g)	23.000	11.000	30.000	0.80
Zn (ug/g)	93.000	65.000	111.000	3.22	Cr (ug/g)	19.000	9.000	26.000	0.66
Ni (ug/g)	27.000	16.000	35.000	0.94					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-220677

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7908 COMPLETE: 7908 ROW= 294

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 14230 TOTAL; 18514 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.04 TOTAL $/CMPM; 7.04

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.550	< 1.000	4.400	< 753.48	COD (mg/g)	40.000	10.000	65.000	1181.93
O&G (mg/g)	< 0.600	< 0.600	< 0.600	< 17.73	TKN (mg/g)	0.850	0.200	1.300	25.12
NH3 (mg/g)	0.048	< 0.010	0.075	< 1.42	TOTAL P (mg/g)	0.480	0.270	0.580	14.18
PCB (ug/g)	0.069	0.032	0.094	0.00	Hg (ug/g)	0.100	< 0.100	0.100	< 0.00
Pb (ug/g)	32.000	15.000	45.000	0.95	As (ug/g)	11.000	8.000	12.000	0.33
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.06	Cu (ug/g)	23.000	11.000	30.000	0.68
Zn (ug/g)	93.000	65.000	111.000	2.75	Cr (ug/g)	19.000	9.000	26.000	0.56
Ni (ug/g)	27.000	16.000	35.000	0.80					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-220677

LOCATION: CONNEAUT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7503 COMPLETE: 7504 ROW= 210

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 185165 TOTAL; 206925 DRY DENSITY(Kg/L); 1.43
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.10 TOTAL $/CMPM; 1.10

REMARKS: WEST BASIN OF OUTER HARBOR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.690	3.390	4.270	10918.81	COD (mg/g)	46.000	43.000	52.000	13611.53
O&G (mg/g)	0.610	0.350	0.940	180.50	TKN (mg/g)	0.880	0.770	1.100	260.39
TOTAL P (mg/g)	0.520	0.460	0.640	153.87	Hg (ug/g)	0.400	< 0.200	0.700	< 0.12
Pb (ug/g)	22.000	< 10.000	45.000	< 6.51	As (ug/g)	8.000	7.000	9.000	2.37
Cd (ug/g)	4.100	1.900	5.400	1.21	Cu (ug/g)	38.000	26.000	54.000	11.24
Zn (ug/g)	210.000	100.000	410.000	62.14	Cr (ug/g)	32.000	23.000	41.000	9.47
Ni (ug/g)	133.000	110.000	150.000	39.36					

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES: USEPA-030674

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7504 COMPLETE: 7506 ROW= 230

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 30278 TOTAL; 43463 DRY DENSITY(Kg/L); 1.54
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.02 TOTAL $/CMPM; 4.02

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.750	4.370	8.100	3853.65	COD (mg/g)	57.200	45.000	83.000	3833.54
O&G (mg/g)	1.860	0.800	3.800	124.66	TKN (mg/g)	2.830	0.560	3.500	189.67
TOTAL P (mg/g)	0.940	0.550	1.300	63.00	Hg (ug/g)	< 0.300	< 0.100	< 0.500	< 0.02
Pb (ug/g)	32.000	19.000	50.000	2.14	Zn (ug/g)	151.000	100.000	160.000	10.12
Cr (ug/g)	70.000	44.000	120.000	4.69					

SAMPLING DATES: EPA-270374/190275

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7604 COMPLETE: 7604 ROW= 246

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 48498 TOTAL; 48498 DRY DENSITY(Kg/L); 1.39

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.94 TOTAL $/CMPM; 2.94

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.490	3.200	7.110	3695.61	COD (mg/g)	51.500	27.000	73.000	3466.73
O&G (mg/g)	2.200	1.400	3.800	148.09	TKN (mg/g)	2.100	0.900	3.500	141.36
NH3 (mg/g)	0.260	0.240	0.290	17.50	TOTAL P (mg/g)	0.950	0.240	1.400	63.95
Hg (ug/g)	0.300	< 0.100	< 0.500	< 0.02	Pb (ug/g)	25.000	15.000	44.000	1.68
As (ug/g)	12.000	11.000	14.000	0.81	Cd (ug/g)	1.000	< 1.000	1.700	< 0.07
Cu (ug/g)	37.000	30.000	46.000	2.49	Zn (ug/g)	150.000	100.000	200.000	10.10
Cr (ug/g)	72.000	49.000	98.000	4.85	Ni (ug/g)	34.000	23.000	40.000	2.29

OTHER PARAMETERS Ba,Co,CN,Fe,Mn,Mg,PH

SAMPLING DATES: EPA-190275/270374

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7712 COMPLETE: 7712 ROW= 265

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 6423 TOTAL; 7715 DRY DENSITY(Kg/L); 1.64

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.30 TOTAL $/CMPM; 7.30

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.370	4.370	4.370	551.23	COD (mg/g)	45.000	45.000	45.000	567.63
O&G (mg/g)	1.200	1.200	1.200	15.14	TKN (mg/g)	2.300	2.300	2.300	29.01
NH3 (mg/g)	0.160	0.160	0.160	2.02	TOTAL P (mg/g)	1.100	1.100	1.100	13.88
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	47.000	47.000	47.000	0.59
As (ug/g)	10.000	10.000	10.000	0.13	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.01
Cu (ug/g)	31.000	31.000	31.000	0.39	Zn (ug/g)	160.000	160.000	160.000	2.02
Cr (ug/g)	120.000	120.000	120.000	1.51	Ni (ug/g)	16.000	16.000	16.000	0.20

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO

SAMPLING DATES: EPA-190275

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7805 COMPLETE: 7805 ROW= 281

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 62758 TOTAL; 73899 DRY DENSITY(Kg/L); 1.42
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.29 TOTAL $/CMPM; 4.29

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.030	4.870	8.350	6314.31	COD (mg/g)	73.200	58.000	96.000	7665.13
O&G (mg/g)	1.090	< 0.600	1.800	< 114.14	TKN (mg/g)	1.750	1.500	2.100	183.25
NH3 (mg/g)	0.148	0.120	0.180	15.50	TOTAL P (mg/g)	0.565	0.450	0.750	59.16
PCB (ug/g)	0.105	0.071	0.145	0.01	Hg (ug/g)	0.200	< 0.100	0.400	< 0.02
Pb (ug/g)	37.000	33.000	53.000	3.87	As (ug/g)	14.000	12.000	16.000	1.47
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.21	Cu (ug/g)	22.000	20.000	23.000	2.30
Zn (ug/g)	99.000	92.000	111.000	10.37	Cr (ug/g)	53.000	43.000	62.000	5.55
Ni (ug/g)	28.000	25.000	35.000	2.93					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240677

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LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7903 COMPLETE: 7904 ROW= 300

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 21715 TOTAL; 21715 DRY DENSITY(Kg/L); 1.97
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.57 TOTAL $/CMPM; 6.57

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.290	0.000	0.000	1835.20	COD (mg/g)	50.000	0.000	0.000	2138.93
O&G (mg/g)	< 0.600	0.000	0.000	< 25.67	TKN (mg/g)	1.700	0.000	0.000	72.72
NH3 (mg/g)	0.140	0.000	0.000	5.99	TOTAL P (mg/g)	0.620	0.000	0.000	26.52
PCB (ug/g)	0.154	0.000	0.000	0.01	Hg (ug/g)	< 0.100	0.000	0.000	< 0.00
Pb (ug/g)	45.000	0.000	0.000	1.93	As (ug/g)	20.000	0.000	0.000	0.86
Cd (ug/g)	< 2.000	0.000	0.000	< 0.09	Cu (ug/g)	23.000	0.000	0.000	0.98
Zn (ug/g)	98.000	0.000	0.000	4.19	Cr (ug/g)	56.000	0.000	0.000	2.40
Ni (ug/g)	28.000	0.000	0.000	1.20					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240677

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7610 COMPLETE: 7611 ROW= 254

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 52375 TOTAL: 63044 DRY DENSITY(Kg/L): 1.39
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 2.70 TOTAL $/CMPM: 2.70
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.100	3.200	6.900	5382.18	COD (mg/g)	56.200	27.000	72.000	4958.66
O&G (mg/g)	2.000	1.400	2.600	176.46	TKN (mg/g)	1.700	0.900	2.100	150.00
TOTAL P (mg/g)	0.660	0.430	0.730	58.23	Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.04
Pb (ug/g)	30.000	20.000	40.000	2.65	Zn (ug/g)	173.000	100.000	400.000	15.26
Cr (ug/g)	70.000	44.000	102.000	6.18					

SAMPLING DATES: EPA-270375

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7704 COMPLETE: 7704 ROW= 269

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 53522 TOTAL: 61168 DRY DENSITY(Kg/L): 1.68
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 1.95 TOTAL $/CMPM: 1.95
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.910	1.550	7.110	5045.63	COD (mg/g)	48.900	12.000	73.000	5025.07
O&G (mg/g)	1.710	0.800	3.800	175.72	TKN (mg/g)	2.440	0.560	3.500	250.74
NH3 (mg/g)	0.210	0.033	0.300	21.58	TOTAL P (mg/g)	1.160	0.440	1.500	119.20
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	28.000	10.000	57.000	2.88
As (ug/g)	12.000	6.000	17.000	1.23	Cd (ug/g)	1.300	< 1.000	2.500	< 0.13
Cu (ug/g)	35.000	26.000	46.000	3.60	Zn (ug/g)	150.000	80.000	168.000	15.41
Cr (ug/g)	86.000	55.000	130.000	8.84	Ni (ug/g)	30.000	16.000	40.000	3.08

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO
SAMPLING DATES: EPA-190275

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7812 COMPLETE: 7901 ROW= 283

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 27526 TOTAL) 30684 DRY DENSITY(Kg/L)) 1.45
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 8.31 TOTAL $/CMPM) 8.31
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.030	4.870	8.350	2688.41	COD (mg/g)	73.200	58.000	96.000	3263.54
O&G (mg/g)	1.090	< 0.600	1.800	< 48.60	TKN (mg/g)	1.750	1.500	2.100	78.02
NH3 (mg/g)	0.148	0.120	0.180	6.60	TOTAL P (mg/g)	0.565	0.450	0.750	25.19
PCB (ug/g)	0.105	0.071	0.145	0.00	Hg (ug/g)	0.200	< 0.100	0.400	< 0.01
Pb (ug/g)	37.000	33.000	53.000	1.65	As (ug/g)	14.000	12.000	16.000	0.62
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.09	Cu (ug/g)	22.000	20.000	23.000	0.98
Zn (ug/g)	99.000	92.000	111.000	4.41	Cr (ug/g)	53.000	43.000	62.000	2.36
Ni (ug/g)	28.000	25.000	35.000	1.25					

OTHER PARAMETERS Fe,Mn,Mg,PEST
SAMPLING DATES: EPA-240677

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7906 COMPLETE: 7908 ROW= 309

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 126318 TOTAL) 126318 DRY DENSITY(Kg/L)) 1.50
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.86 TOTAL $/CMPM) 2.86
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.630	2.210	9.320	10667.56	COD (mg/g)	69.200	40.000	120.000	13111.81
O&G (mg/g)	1.230	< 0.600	1.800	< 233.06	TKN (mg/g)	1.740	1.200	2.200	329.69
NH3 (mg/g)	0.149	0.099	0.180	28.23	TOTAL P (mg/g)	0.600	0.370	0.760	113.69
PCB (ug/g)	0.204	0.071	1.099	0.04	Hg (ug/g)	0.100	< 0.100	0.400	< 0.02
Pb (ug/g)	40.000	33.000	53.000	7.58	As (ug/g)	14.000	12.000	20.000	2.65
Cd (ug/g)	2.000	< 2.000	3.000	< 0.38	Cu (ug/g)	26.000	20.000	47.000	4.93
Zn (ug/g)	109.000	92.000	149.000	20.65	Cr (ug/g)	49.000	36.000	62.000	9.28
Ni (ug/g)	31.000	25.000	39.000	5.87					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240677

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7604 COMPLETE: 7604 ROW= 256

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 48498 TOTAL; 63560 DRY DENSITY(Kg/L): 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.72 TOTAL $/CMPM; 2.72
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.750	6.000	8.100	7722.54	COD (mg/g)	63.300	50.000	83.000	7242.03
O&G (mg/g)	1.750	1.200	2.500	200.21	TKN (mg/g)	1.850	1.300	2.200	211.65
TOTAL P (mg/g)	0.730	0.550	1.000	83.52	Hg (ug/g)	< 0.500	< 0.500	< 0.500	< 0.06
Pb (ug/g)	37.000	20.000	50.000	4.23	Zn (ug/g)	133.000	120.000	160.000	15.22
Cr (ug/g)	59.000	44.000	80.000	6.75					

SAMPLING DATES: EPA-270374

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LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7805 COMPLETE: 7805 ROW= 284

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 14392 TOTAL; 17834 DRY DENSITY(Kg/L): 1.41
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.40 TOTAL $/CMPM; 1.40
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.030	4.870	8.350	1513.07	COD (mg/g)	73.200	58.000	96.000	1836.77
O&G (mg/g)	1.090	< 0.600	1.800	< 27.35	TKN (mg/g)	1.750	1.500	2.100	43.91
NH3 (mg/g)	0.148	0.120	0.180	3.71	TOTAL P (mg/g)	0.565	0.450	0.750	14.18
PCB (ug/g)	0.105	0.071	0.145	0.00	Hg (ug/g)	0.200	< 0.100	0.400	< 0.01
Pb (ug/g)	37.000	33.000	53.000	0.93	As (ug/g)	14.000	12.000	16.000	0.35
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.05	Cu (ug/g)	22.000	20.000	23.000	0.55
Zn (ug/g)	99.000	92.000	111.000	2.48	Cr (ug/g)	53.000	43.000	62.000	1.33
Ni (ug/g)	28.000	25.000	35.000	0.70					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240677

LOCATION: FAIRPORT HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7804 COMPLETE: 7804 ROW= 289

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 43885 TOTAL; 43885 DRY DENSITY(Kg/L)) 1.97
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.30 TOTAL $/CMPM; 3.30
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.880	2.210	9.320	4218.93	COD (mg/g)	63.200	40.000	120.000	5463.86
O&G (mg/g)	1.100	< 0.600	2.800	< 95.10	TKN (mg/g)	1.680	1.200	2.200	145.24
NH3 (mg/g)	0.640	0.570	0.180	55.33	TOTAL P (mg/g)	0.640	0.570	0.760	55.33
PCB (ug/g)	0.323	0.091	1.099	0.03	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	42.000	37.000	48.000	3.63	As (ug/g)	15.000	12.000	20.000	1.30
Cd (ug/g)	2.000	< 2.000	3.000	< 0.17	Cu (ug/g)	31.000	23.000	47.000	2.68
Zn (ug/g)	122.000	98.000	149.000	10.55	Cr (ug/g)	46.000	36.000	56.000	3.98
Ni (ug/g)	34.000	28.000	39.000	2.94					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-240677

LOCATION: HURON HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7503 COMPLETE: 7504 ROW= 234

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 31007 TOTAL; 84679 DRY DENSITY(Kg/L)) 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.32 TOTAL $/CMPM; 1.32
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.500	6.000	7.000	7694.78	COD (mg/g)	82.500	72.000	93.000	9766.45
O&G (mg/g)	1.100	0.700	1.500	130.22	TKN (mg/g)	2.550	2.300	2.800	301.87
NH3 (mg/g)	0.165	0.150	0.180	19.53	TOTAL P (mg/g)	0.670	0.700	0.640	79.32
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	10.000	6.000	14.000	1.18
As (ug/g)	12.000	11.000	13.000	1.42	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.12
Cu (ug/g)	34.000	28.000	40.000	4.02	Zn (ug/g)	103.000	93.000	112.000	12.19
Cr (ug/g)	44.000	43.000	44.000	5.21	Ni (ug/g)	37.000	22.000	52.000	4.38

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-100975

LOCATION: HURON HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7806 COMPLETE: 7908 ROW= 209

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY; 19820 TOTAL; 19820 DRY DENSITY(Kg/L); 1.58
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.47 TOTAL $/CMPM; 3.47
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.520	2.250	4.810	1098.82	As (ug/g)	8.000	5.000	10.000	0.25
Ni (ug/g)	35.000	25.000	40.000	1.09					

OTHER PARAMETERS Mg
SAMPLING DATES: USEPA-300976

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LOCATION: HURON HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7900 COMPLETE: 7900 ROW= 305

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY; 116920 TOTAL; 116920 DRY DENSITY(Kg/L); 1.48
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 10.46 TOTAL $/CMPM; 13.91
REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.050	2.900	6.370	8709.08	COD (mg/g)	54.000	45.000	61.000	9312.68
O&G (mg/g)	0.810	< 0.250	1.300	< 139.69	TKN (mg/g)	1.310	0.320	1.800	225.92
NH3 (mg/g)	0.112	0.057	0.160	19.32	TOTAL P (mg/g)	0.335	0.088	0.440	57.77
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.02	Pb (ug/g)	13.000	9.000	15.000	2.24
As (ug/g)	9.000	5.000	12.000	1.55	Cd (ug/g)	11.000	< 1.000	1.200	< 1.90
Cu (ug/g)	28.000	18.000	34.000	4.83	Zn (ug/g)	94.000	70.000	108.000	16.21
Cr (ug/g)	35.000	14.000	53.000	6.04	Ni (ug/g)	43.000	36.000	50.000	7.42

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-100975/080976

LOCATION: L. ERIE SAILING C. MICH & OHIO, OH   BASIN: ERIE   PROJECT BEGAN: 7607   COMPLETE: 7607   ROW= 258

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 526699 TOTAL; 564925 DRY DENSITY(Kg/L); 1.42
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.39 TOTAL $/CMPM; 0.39

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.740	3.820	6.000	37890.08	COD (mg/g)	68.900	60.800	78.800	55076.52
O&G (mg/g)	0.548	0.247	1.013	438.05	TKN (mg/g)	2.070	1.760	2.580	1654.69
NH3 (mg/g)	0.067	0.056	0.091	53.56	TOTAL P (mg/g)	0.683	0.569	0.757	545.97
Hg (ug/g)	0.910	0.790	1.040	0.73	Pb (ug/g)	78.100	64.300	104.000	62.43
As (ug/g)	2.600	1.600	4.700	2.08	Cd (ug/g)	3.700	3.000	4.900	2.96
Cu (ug/g)	54.000	43.400	72.300	43.17	Zn (ug/g)	218.000	180.000	279.000	174.26
Ni (ug/g)	51.800	43.600	66.000	41.41					

OTHER PARAMETERS   Ba,Fe,Mn,Mg
SAMPLING DATES: COE-0976

LOCATION: LORAIN HARBOR   , OH   BASIN: ERIE   PROJECT BEGAN: 7511   COMPLETE: 7512   ROW= 236

PHYSICAL DATA

MATERIAL: SILT   DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 78160 TOTAL; 78160 DRY DENSITY(Kg/L); 1.46
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.84 TOTAL $/CMPM; 1.84

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.080	8.530	9.940	10333.13	COD (mg/g)	136.500	121.000	150.000	15533.83
O&G (mg/g)	14.200	9.000	23.000	1615.97	TKN (mg/g)	2.980	2.400	3.300	339.13
NH3 (mg/g)	0.390	0.240	0.670	44.38	TOTAL P (mg/g)	2.230	1.900	2.500	253.78
Hg (ug/g)	0.300	0.300	0.400	0.03	Pb (ug/g)	179.000	160.000	216.000	20.37
As (ug/g)	15.000	11.000	19.000	1.71	Cd (ug/g)	22.000	16.000	29.000	2.50
Cu (ug/g)	246.000	165.000	325.000	28.00	Zn (ug/g)	970.000	770.000	1230.000	110.39
Cr (ug/g)	147.000	126.000	182.000	16.73	Ni (ug/g)	81.000	65.000	100.000	9.22

OTHER PARAMETERS   Ba,CN,Fe,Mn,Mg
SAMPLING DATES: EPA-250275

LOCATION: LORAIN HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7606 COMPLETE: 7606 ROW= 247

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 15932 TOTAL; 16849 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.20 TOTAL $/CMPM; 5.20

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.660	8.530	8.780	2042.77	COD (mg/g)	133.000	121.000	145.000	3137.28
O&G (mg/g)	9.350	9.000	9.700	220.55	TKN (mg/g)	3.250	3.200	3.300	76.66
NH3 (mg/g)	0.505	0.340	0.670	11.91	TOTAL P (mg/g)	2.400	2.300	2.500	56.61
Hg (ug/g)	0.300	0.300	0.300	0.01	Pb (ug/g)	162.000	160.000	164.000	3.82
As (ug/g)	14.000	11.000	16.000	0.33	Cd (ug/g)	17.000	16.000	18.000	0.40
Cu (ug/g)	245.000	165.000	325.000	5.78	Zn (ug/g)	835.000	770.000	900.000	19.70
Cr (ug/g)	130.000	126.000	134.000	3.07	Ni (ug/g)	75.000	65.000	85.000	1.77

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES: EPA-250275

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LOCATION: LORAIN HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7707 COMPLETE: 7707 ROW= 262

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 13036 TOTAL; 17629 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.23 TOTAL $/CMPM; 7.23

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.940	9.940	9.940	2453.25	COD (mg/g)	150.000	150.000	150.000	3702.09
O&G (mg/g)	23.000	23.000	23.000	567.65	TKN (mg/g)	3.000	3.000	3.000	74.04
NH3 (mg/g)	0.310	0.310	0.310	7.65	TOTAL P (mg/g)	1.900	1.900	1.900	46.89
Hg (ug/g)	0.300	0.300	0.300	0.01	Pb (ug/g)	177.000	177.000	177.000	4.37
As (ug/g)	15.000	15.000	15.000	0.37	Cd (ug/g)	23.000	23.000	23.000	0.57
Cu (ug/g)	225.000	225.000	225.000	5.55	Zn (ug/g)	980.000	980.000	980.000	24.19
Cr (ug/g)	146.000	146.000	146.000	3.60	Ni (ug/g)	75.000	75.000	75.000	1.85

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES: EPA-250277

LOCATION: LORAIN HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7904 COMPLETE: 7905 ROW= 291

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 54292 TOTAL: 61015 DRY DENSITY(Kg/L): 1.40

COSTS: CAPITAL CONTAINMENT: 6 O&M CONTAINMENT: 0 DREDGING $/CMPM: 3.77 TOTAL $/CMPM: 10.00

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.080	8.530	9.940	7767.31	COD (mg/g)	136.500	121.000	150.000	11676.62
O&G (mg/g)	14.200	9.000	23.000	1214.71	TKN (mg/g)	2.980	2.400	3.300	254.92
NH3 (mg/g)	0.390	0.240	0.670	33.36	TOTAL P (mg/g)	2.230	1.900	2.500	190.76
Hg (ug/g)	0.300	0.300	0.400	0.03	Pb (ug/g)	179.000	160.000	216.000	15.31
As (ug/g)	15.000	11.000	19.000	1.28	Cd (ug/g)	22.000	16.000	29.000	1.88
Cu (ug/g)	246.000	165.000	325.000	21.04	Zn (ug/g)	970.000	770.000	1230.000	82.98
Cr (ug/g)	147.000	126.000	182.000	12.57	Ni (ug/g)	81.000	65.000	100.000	6.93

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg

SAMPLING DATES: EPA-250277

LOCATION: LORAIN HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7609 COMPLETE: 7610 ROW= 211

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 4023 TOTAL: 7846 DRY DENSITY(Kg/L): 1.45

COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 8.12 TOTAL $/CMPM: 8.12

REMARKS: NEAR UPSTREAM LIMIT OF RIVER

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.940	9.940	9.940	1130.84	COD (mg/g)	150.000	150.000	150.000	1706.51
O&G (mg/g)	23.000	23.000	23.000	261.66	TKN (mg/g)	3.000	3.000	3.000	34.13
NH3 (mg/g)	0.310	0.310	0.310	3.53	TOTAL P (mg/g)	1.900	1.900	1.900	21.62
Hg (ug/g)	0.300	0.300	0.300	0.00	Pb (ug/g)	177.000	177.000	177.000	2.01
As (ug/g)	15.000	15.000	15.000	0.17	Cd (ug/g)	23.000	23.000	23.000	0.26
Cu (ug/g)	225.000	225.000	225.000	2.56	Zn (ug/g)	980.000	980.000	980.000	11.15
Cr (ug/g)	146.000	146.000	146.000	1.66	Ni (ug/g)	75.000	75.000	75.000	0.85

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg

SAMPLING DATES: USEPA-250275

LOCATION: LORAIN HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7903 COMPLETE: 7904 ROW= 293

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 51228 TOTAL; 61474 DRY DENSITY(Kg/L): 1.40
COSTS: CAPITAL CONTAINMENT; 6 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.92 TOTAL $/CMPM; 11.14

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	9.080	8.530	9.940	7814.57	COD (mg/g)	136.500	121.000	150.000	11747.68
O&G (mg/g)	14.200	9.000	23.000	1222.10	TKN (mg/g)	2.980	2.400	3.300	256.47
NH3 (mg/g)	0.390	0.240	0.670	33.56	TOTAL P (mg/g)	2.230	1.900	2.500	191.92
Hg (ug/g)	0.300	0.300	0.400	0.03	Pb (ug/g)	179.000	160.000	216.000	15.41
As (ug/g)	15.000	11.000	19.000	1.29	Cd (ug/g)	22.000	16.000	29.000	1.89
Cu (ug/g)	246.000	165.000	325.000	21.17	Zn (ug/g)	970.000	770.000	1230.000	83.48
Cr (ug/g)	147.000	126.000	182.000	12.65	Ni (ug/g)	81.000	65.000	100.000	6.97

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES: EPA-250277

LOCATION: ROCKY RIVER , OH BASIN: ERIE PROJECT BEGAN: 7605 COMPLETE: 7605 ROW= 245

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: BACKHOE

QUANTITY(CMPM): PAY; 29204 TOTAL; 29204 DRY DENSITY(Kg/L): 1.45
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 12.56 TOTAL $/CMPM; 12.56

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.200	2.600	6.700	1783.40	COD (mg/g)	41.200	14.000	79.000	1749.43
O&G (mg/g)	0.900	< 0.200	2.200	< 38.22	TKN (mg/g)	1.440	0.440	3.100	61.14
NH3 (mg/g)	0.260	0.060	0.560	11.04	TOTAL P (mg/g)	0.980	0.460	1.900	41.61
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.00	Pb (ug/g)	63.000	30.000	100.000	2.68
As (ug/g)	12.000	5.000	15.000	0.51	Cd (ug/g)	1.800	< 1.000	4.200	< 0.08
Cu (ug/g)	27.000	13.000	58.000	1.15	Zn (ug/g)	166.000	89.000	270.000	7.05
Cr (ug/g)	37.000	19.000	75.000	1.57	Ni (ug/g)	25.000	16.000	36.000	1.06

OTHER PARAMETERS Ba,Co,CN,Fe,Mn,Hg,PH
SAMPLING DATES: EPA-090475

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7505 COMPLETE: 7506 ROW= 241

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER
QUANTITY(CMPM): PAY; 51589 TOTAL; 51589 DRY DENSITY(Kg/L); 1.40
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.95 TOTAL $/CMPM; 0.95

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.950	1.960	8.650	3564.90	COD (mg/g)	59.000	22.000	116.000	4249.08
O&G (mg/g)	0.700	< 0.500	1.000	< 50.41	TKN (mg/g)	2.180	0.800	3.900	157.00
NH3 (mg/g)	0.150	0.050	0.280	10.80	TOTAL P (mg/g)	0.690	0.340	1.100	49.69
Hg (ug/g)	0.100	< 0.100	0.200	< 0.01	Pb (ug/g)	15.000	7.000	30.000	1.08
As (ug/g)	8.000	4.000	11.000	0.58	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.07
Cu (ug/g)	62.000	39.000	90.000	4.47	Zn (ug/g)	134.000	70.000	230.000	9.65
Cr (ug/g)	30.000	19.000	45.000	2.16	Ni (ug/g)	29.000	< 15.000	40.000	< 2.09

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES: EPA-240275/250275

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7609 COMPLETE: 7610 ROW= 259

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER
QUANTITY(CMPM): PAY; 86170 TOTAL; 102686 DRY DENSITY(Kg/L); 1.32
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.91 TOTAL $/CMPM; 2.91

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.890	2.860	8.650	9346.16	COD (mg/g)	77.600	31.000	116.000	10526.30
O&G (mg/g)	0.890	< 0.500	1.600	< 120.73	TKN (mg/g)	2.960	1.200	3.900	401.52
NH3 (mg/g)	0.236	0.070	0.370	32.01	TOTAL P (mg/g)	0.870	0.500	1.100	118.01
Hg (ug/g)	0.200	< 0.100	0.200	< 0.03	Pb (ug/g)	32.000	10.000	68.000	4.34
As (ug/g)	10.000	6.000	12.000	1.36	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.14
Cu (ug/g)	98.000	41.000	194.000	13.29	Zn (ug/g)	211.000	105.000	335.000	28.62
Cr (ug/g)	39.000	24.000	50.000	5.29	Ni (ug/g)	34.000	< 15.000	65.000	< 4.61

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-240275/250275

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7708 COMPLETE: 7709 ROW= 263

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 38995 TOTAL; 43582 DRY DENSITY(Kg/L)) 1.55
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.38 TOTAL $/CMPM; 4.38

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.320	5.320	5.320	3598.41	COD (mg/g)	63.000	63.000	63.000	4261.27
O&G (mg/g)	< 0.600	< 0.600	< 0.600	< 40.58	TKN (mg/g)	2.400	2.400	2.400	162.33
NH3 (mg/g)	0.160	0.160	0.160	10.82	TOTAL P (mg/g)	0.760	0.760	0.760	51.41
PCB (ug/g)	0.343	0.343	0.343	0.02	Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01
Pb (ug/g)	30.000	30.000	30.000	2.03	As (ug/g)	7.000	7.000	7.000	0.47
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.14	Cu (ug/g)	43.000	43.000	43.000	2.91
Zn (ug/g)	77.000	77.000	77.000	5.21	Cr (ug/g)	27.000	27.000	27.000	1.83
Ni (ug/g)	35.000	35.000	35.000	2.37					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-280777

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7906 COMPLETE: 7908 ROW= 301

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 99354 TOTAL; 99354 DRY DENSITY(Kg/L)) 1.29
COSTS: CAPITAL CONTAINMENT; 3 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.75 TOTAL $/CMPM; 10.20

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.710	7.000	16.600	11197.93	COD (mg/g)	106.000	78.000	190.000	13627.79
O&G (mg/g)	0.820	< 0.600	1.300	< 105.42	TKN (mg/g)	3.620	2.700	4.300	465.40
NH3 (mg/g)	0.380	0.270	0.490	48.85	TOTAL P (mg/g)	1.030	0.900	1.300	132.42
PCB (ug/g)	0.267	0.168	0.644	0.03	Hg (ug/g)	0.100	< 0.100	0.200	<0.01
Pb (ug/g)	54.000	44.000	73.000	6.94	As (ug/g)	10.000	7.000	13.000	1.29
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.26	Cu (ug/g)	66.000	38.000	145.000	8.49
Zn (ug/g)	121.000	98.000	173.000	15.56	Cr (ug/g)	33.000	27.000	139.000	4.24
Ni (ug/g)	43.000	31.000	62.000	5.53					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-280777

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7507 COMPLETE: 7508 ROW= 242

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 309892 TOTAL: 371825 DRY DENSITY(Kg/L): 1.40
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 0.89 TOTAL $/CMPM: 0.89

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.510	4.760	9.110	38981.98	COD (mg/g)	78.700	51.000	101.000	40850.63
O&G (mg/g)	0.840	< 0.500	1.000	< 436.02	TKN (mg/g)	3.050	1.700	3.500	1583.16
NH3 (mg/g)	0.222	0.120	0.270	115.23	TOTAL P (mg/g)	0.990	0.800	1.200	513.88
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.05	Pb (ug/g)	28.000	6.000	48.000	14.53
As (ug/g)	12.000	7.000	19.000	6.23	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.52
Cu (ug/g)	110.000	49.000	173.000	57.10	Zn (ug/g)	201.000	120.000	270.000	104.33
Cr (ug/g)	39.000	21.000	54.000	20.24	Ni (ug/g)	48.000	15.000	70.000	24.92

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg
SAMPLING DATES:

LOCATION: SANDUSKY HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7709 COMPLETE: 7712 ROW= 264

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-*41971, OPEN LAKE-*11845
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 49699 TOTAL: 53816 DRY DENSITY(Kg/L): 1.34
COSTS: CAPITAL CONTAINMENT: 3 O&M CONTAINMENT: 0 DREDGING $/CMPM: 8.94 TOTAL $/CMPM: 12.39

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	8.710	7.000	16.600	6290.46	COD (mg/g)	106.000	78.000	190.000	7655.43
O&G (mg/g)	0.820	< 0.600	1.300	< 59.22	TKN (mg/g)	3.620	2.700	4.300	261.44
NH3 (mg/g)	0.381	0.270	0.490	27.52	TOTAL P (mg/g)	1.030	0.900	1.300	74.39
PCB (ug/g)	0.267	0.168	0.644	0.02	Hg (ug/g)	0.100	< 0.100	0.200	< 0.01
Pb (ug/g)	54.000	44.000	73.000	3.90	As (ug/g)	10.000	7.000	13.000	0.72
Cd (ug/g)	< 2.000	< 2.000	< 2.000	< 0.14	Cu (ug/g)	66.000	38.000	145.000	4.77
Zn (ug/g)	121.000	98.000	173.000	8.74	Cr (ug/g)	33.000	27.000	139.000	2.38
Ni (ug/g)	43.000	31.000	62.000	3.11					

OTHER PARAMETERS Fe,Mn,Mg,PEST. SCAN
SAMPLING DATES: EPA-280777

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7704 COMPLETE: 7704 ROW= 320

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 12216 TOTAL: 12981 DRY DENSITY(Kg/L): 1.44
COSTS: CAPITAL CONTAINMENT: 2 O&M CONTAINMENT: 0 DREDGING $/CMPM: 5.96 TOTAL $/CMPM: 8.08

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.200	10.100	12.200	2089.21	COD (mg/g)	61.700	49.300	74.100	1150.93
O&G (mg/g)	1.190	1.160	1.220	22.20	TKN (mg/g)	2.320	1.830	2.810	43.28
TOTAL P (mg/g)	0.890	0.740	1.030	16.60	Hg (ug/g)	0.200	0.200	0.300	0.00
Pb (ug/g)	53.000	43.000	63.000	0.99	As (ug/g)	8.600	8.300	8.900	0.16
Cd (ug/g)	7.000	7.000	8.000	0.13	Cu (ug/g)	30.000	24.000	36.000	0.56
Zn (ug/g)	118.000	80.000	155.000	2.20	Cr (ug/g)	59.000	40.000	77.000	1.10
Ni (ug/g)	39.000	27.000	50.000	0.73					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR OH BASIN: ERIE PROJECT BEGAN: 7801 COMPLETE: 7801 ROW= 324

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 3841 TOTAL: 4193 DRY DENSITY(Kg/L): 1.43
COSTS: CAPITAL CONTAINMENT: 2 O&M CONTAINMENT: 0 DREDGING $/CMPM: 19.79 TOTAL $/CMPM: 21.91

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.830	10.400	11.400	651.18	COD (mg/g)	79.000	74.600	83.300	475.01
O&G (mg/g)	1.090	0.810	1.410	6.55	TKN (mg/g)	3.280	3.090	3.390	19.72
TOTAL P (mg/g)	0.920	0.690	1.660	5.53	Hg (ug/g)	0.400	0.300	0.500	0.00
Pb (ug/g)	43.000	16.000	60.000	0.26	As (ug/g)	7.000	6.000	9.000	0.04
Cd (ug/g)	6.000	6.000	9.000	0.04	Cu (ug/g)	24.000	22.000	26.000	0.14
Zn (ug/g)	113.000	109.000	117.000	0.68	Cr (ug/g)	65.000	54.000	74.000	0.39
Ni (ug/g)	37.000	34.000	39.000	0.22					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7907 COMPLETE: 7908 ROW= 329

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 72599 TOTAL; 72599 DRY DENSITY(Kg/L): 1.47
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.21 TOTAL $/CMPM; 6.33

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.610	6.600	6.610	7030.23	COD (mg/g)	110.000	100.000	120.000	11699.33
O&G (mg/g)	0.900	0.800	1.000	95.72	TKN (mg/g)	3.950	3.900	4.000	420.11
NH3 (mg/g)	0.410	0.390	0.420	43.61	TOTAL P (mg/g)	1.300	1.100	1.500	138.26
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	31.000	17.000	44.000	3.30
As (ug/g)	11.000	10.000	12.000	1.17	Cd (ug/g)	2.100	1.900	2.200	0.22
Cu (ug/g)	44.000	39.000	48.000	4.68	Zn (ug/g)	185.000	168.000	202.000	19.68
Cr (ug/g)	66.000	64.000	67.000	7.02	Ni (ug/g)	53.000	52.000	54.000	5.64

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-110975

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LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7507 COMPLETE: 7510 ROW= 314

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-+199360, CONFINED-*79935
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 279295 TOTAL; 279295 DRY DENSITY(Kg/L): 1.45
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.64 TOTAL $/CMPM; 1.64

REMARKS: 1977 TOLEDO HBR. JURISD. WENT FROM DET.COE TO BUFFALO COE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7610 COMPLETE: 7612 ROW= 319

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED

EQUIPMENT TYPE: HOPPER DREDGE

QUANTITY(CMPM): PAY: 262253 TOTAL: 285268 DRY DENSITY(Kg/L): 1.39

COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 2.64 TOTAL $/CMPM: 2.64

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.940	4.880	11.000	31506.54	COD (mg/g)	89.600	83.100	96.000	35553.98
O&G (mg/g)	3.000	0.800	5.200	1190.42	TKN (mg/g)	3.420	2.900	3.930	1357.08
TOTAL P (mg/g)	1.500	1.300	1.700	595.21	Hg (ug/g)	0.500	0.400	0.600	0.20
Pb (ug/g)	69.000	62.000	75.000	27.38	As (ug/g)	8.500	8.000	8.900	3.37
Cd (ug/g)	6.000	3.000	8.000	2.38	Cu (ug/g)	44.000	36.000	51.000	17.46
Zn (ug/g)	182.000	155.000	208.000	72.22	Cr (ug/g)	86.000	77.000	94.000	34.13
Ni (ug/g)	54.000	50.000	58.000	21.43					

OTHER PARAMETERS Fe

SAMPLING DATES: EPA-270373/110975

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7710 COMPLETE: 7712 ROW= 321

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED

EQUIPMENT TYPE: HOPPER DREDGE

QUANTITY(CMPM): PAY: 112867 TOTAL: 121740 DRY DENSITY(Kg/L): 1.48

COSTS: CAPITAL CONTAINMENT: 2 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.58 TOTAL $/CMPM: 6.70

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.600	9.500	12.200	19034.05	COD (mg/g)	68.400	49.300	83.100	12282.35
O&G (mg/g)	3.080	1.160	5.230	553.06	TKN (mg/g)	2.710	1.830	3.930	486.63
TOTAL P (mg/g)	1.130	0.740	1.660	202.91	Hg (ug/g)	0.400	0.200	0.600	0.07
Pb (ug/g)	51.000	16.000	75.000	9.16	As (ug/g)	8.200	5.700	10.100	1.47
Cd (ug/g)	8.000	7.000	9.000	1.44	Cu (ug/g)	32.000	24.000	47.000	5.75
Zn (ug/g)	123.000	80.000	194.000	22.09	Cr (ug/g)	68.000	40.000	125.000	12.21
Ni (ug/g)	33.000	24.000	50.000	5.93					

OTHER PARAMETERS Fe

SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7804 COMPLETE: 7805 ROW= 325

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 43143 TOTAL: 48538 DRY DENSITY(Kg/L): 1.54
COSTS: CAPITAL CONTAINMENT: 2 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.25 TOTAL $/CMPM: 6.37

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.830	10.400	11.400	8084.75	COD (mg/g)	79.000	74.600	83.300	5897.46
O&G (mg/g)	1.090	0.810	1.410	81.37	TKN (mg/g)	3.280	3.090	3.390	244.86
TOTAL P (mg/g)	0.920	0.690	1.660	68.68	Hg (ug/g)	0.400	0.300	0.500	0.03
Pb (ug/g)	43.000	16.000	60.000	3.21	As (ug/g)	7.000	6.000	9.000	0.52
Cd (ug/g)	6.000	6.000	9.000	0.45	Cu (ug/g)	24.000	22.000	26.000	1.79
Zn (ug/g)	113.000	109.000	117.000	8.44	Cr (ug/g)	65.000	54.000	74.000	4.85
Ni (ug/g)	37.000	34.000	39.000	2.76					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

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LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7905 COMPLETE: 7905 ROW= 330

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 308558 TOTAL: 308558 DRY DENSITY(Kg/L): 1.31
COSTS: CAPITAL CONTAINMENT: 2 O&M CONTAINMENT: 0 DREDGING $/CMPM: 1.50 TOTAL $/CMPM: 3.62

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.400	10.400	10.400	42037.94	COD (mg/g)	74.600	74.600	74.600	30154.14
O&G (mg/g)	0.810	0.810	0.810	327.41	TKN (mg/g)	3.390	3.390	3.390	1370.28
TOTAL P (mg/g)	1.160	1.160	1.160	468.88	Hg (ug/g)	0.500	0.500	0.500	0.20
Pb (ug/g)	53.000	53.000	53.000	21.42	As (ug/g)	6.400	6.400	6.400	2.59
Cd (ug/g)	6.000	6.000	6.000	2.43	Cu (ug/g)	26.000	26.000	26.000	10.51
Zn (ug/g)	112.000	112.000	112.000	45.27	Cr (ug/g)	54.000	54.000	54.000	21.83
Ni (ug/g)	39.000	39.000	39.000	15.76					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7506 COMPLETE: 7507 ROW= 315

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-+142377, CONFINED-+137821
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 280198 TOTAL; 280198 DRY DENSITY(Kg/L); 1.45
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.85 TOTAL $/CMPM; 0.85

REMARKS: 1977 TOLEDO HBR. JURISD. WENT FROM DET.COE TO BUFFALO COE

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7705 COMPLETE: 7705 ROW= 322

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 90422 TOTAL; 96309 DRY DENSITY(Kg/L); 1.45
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.30 TOTAL $/CMPM; 4.42

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.360	2.330	9.890	8881.62	COD (mg/g)	78.000	22.000	120.000	10892.55
O&G (mg/g)	1.100	0.800	1.400	153.61	TKN (mg/g)	2.800	0.400	4.000	391.01
NH3 (mg/g)	0.275	0.051	0.420	38.40	TOTAL P (mg/g)	1.030	0.610	1.500	143.84
Hg (ug/g)	0.100	< 0.100	0.100	< 0.01	Pb (ug/g)	40.000	16.000	62.000	5.59
As (ug/g)	10.000	7.000	11.000	1.40	Cd (ug/g)	2.100	1.000	3.600	0.29
Cu (ug/g)	71.000	46.000	123.000	9.92	Zn (ug/g)	192.000	152.000	234.000	26.81
Cr (ug/g)	81.000	63.000	120.000	11.31	Ni (ug/g)	54.000	45.000	68.000	7.54

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-110974

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7803 COMPLETE: 7804 ROW= 326

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 141765 TOTAL; 159486 DRY DENSITY(Kg/L); 1.31
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.98 TOTAL $/CMPM; 4.10

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.830	10.400	11.400	22626.76	COD (mg/g)	79.000	74.600	83.300	16505.21
O&G (mg/g)	1.090	0.810	1.410	227.73	TKN (mg/g)	3.280	3.090	3.390	685.28
TOTAL P (mg/g)	0.920	0.690	1.660	192.21	Hg (ug/g)	0.400	0.300	0.500	0.08
Pb (ug/g)	43.000	16.000	60.000	8.98	As (ug/g)	7.000	6.000	9.000	1.46
Cd (ug/g)	6.000	6.000	9.000	1.25	Cu (ug/g)	24.000	22.000	26.000	5.01
Zn (ug/g)	113.000	109.000	117.000	23.61	Cr (ug/g)	65.000	54.000	74.000	13.58
Ni (ug/g)	37.000	34.000	39.000	7.73					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7906 COMPLETE: 7906 ROW= 331

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 39684 TOTAL; 39684 DRY DENSITY(Kg/L); 1.41
COSTS: CAPITAL CONTAINMENT; 2 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.72 TOTAL $/CMPM; 5.84

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.400	11.400	11.400	6392.38	COD (mg/g)	83.300	83.300	83.300	4670.92
O&G (mg/g)	1.040	1.040	1.040	58.32	TKN (mg/g)	3.090	3.090	3.090	173.27
TOTAL P (mg/g)	0.900	0.900	0.900	50.47	Hg (ug/g)	0.300	0.300	0.300	0.02
Pb (ug/g)	60.000	60.000	60.000	3.36	As (ug/g)	8.900	8.900	8.900	0.50
Cd (ug/g)	6.000	6.000	6.000	0.34	Cu (ug/g)	22.000	22.000	22.000	1.23
Zn (ug/g)	109.000	109.000	109.000	6.11	Cr (ug/g)	68.000	68.000	68.000	3.81
Ni (ug/g)	38.000	38.000	38.000	2.13					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7510 COMPLETE: 7510 ROW= 316

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 486624 TOTAL) 486624 DRY DENSITY(Kg/L)) 1.45
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 0.00 TOTAL $/CMPM) 0.00

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	6.580	5.990	7.120	46428.80	COD (mg/g)	99.300	87.000	120.000	70066.56
O&G (mg/g)	1.100	0.800	1.600	776.17	TKN (mg/g)	3.600	3.000	4.000	2540.18
NH3 (mg/g)	0.380	0.340	0.420	268.13	TOTAL P (mg/g)	1.280	1.100	1.500	903.17
Hg (ug/g)	0.100	< 0.100	0.200	< 0.07	Pb (ug/g)	36.000	17.000	64.000	25.40
As (ug/g)	11.000	9.000	14.000	7.76	Cd (ug/g)	2.500	1.900	3.600	1.76
Cu (ug/g)	47.000	33.000	69.000	33.16	Zn (ug/g)	190.000	148.000	240.000	134.06
Cr (ug/g)	70.000	53.000	95.000	49.39	Ni (ug/g)	56.000	46.000	72.000	39.51

OTHER PARAMETERS Fe,Mn,Mg,Ba
SAMPLING DATES: EPA-110975

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7707 COMPLETE: 7709 ROW= 323

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 393839 TOTAL) 418458 DRY DENSITY(Kg/L)) 1.43
COSTS: CAPITAL CONTAINMENT) 2 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.23 TOTAL $/CMPM) 4.35

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.100	10.100	12.200	66236.04	COD (mg/g)	73.800	49.300	83.300	44038.02
O&G (mg/g)	2.010	1.040	5.230	1199.41	TKN (mg/g)	3.000	1.830	3.930	1790.16
TOTAL P (mg/g)	1.000	0.690	1.740	596.72	Hg (ug/g)	0.400	0.200	0.600	0.24
Pb (ug/g)	51.000	16.000	63.000	30.43	As (ug/g)	7.500	5.700	8.900	4.48
Cd (ug/g)	7.000	6.000	9.000	4.18	Cu (ug/g)	31.000	22.000	47.000	18.50
Zn (ug/g)	131.000	80.000	194.000	78.17	Cr (ug/g)	77.000	0.000	0.000	45.95
Ni (ug/g)	37.000	0.000	0.000	22.08					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7808 COMPLETE: 7810 ROW= 327

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 370801 TOTAL) 370801 DRY DENSITY(Kg/L)) 1.54
COSTS: CAPITAL CONTAINMENT) 2 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.57 TOTAL $/CMPM) 4.69

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.830	10.400	11.400	61682.30	COD (mg/g)	79.000	74.600	83.300	44994.48
O&G (mg/g)	1.090	0.810	1.410	620.81	TKN (mg/g)	3.280	3.090	3.390	1868.13
TOTAL P (mg/g)	0.920	0.690	1.660	523.99	Hg (ug/g)	0.400	0.300	0.500	0.23
Pb (ug/g)	43.000	16.000	60.000	24.49	As (ug/g)	7.000	6.000	9.000	3.99
Cd (ug/g)	6.000	6.000	9.000	3.42	Cu (ug/g)	24.000	22.000	26.000	13.67
Zn (ug/g)	113.000	109.000	117.000	64.36	Cr (ug/g)	65.000	54.000	74.000	37.02
Ni (ug/g)	37.000	34.000	39.000	21.07					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7908 COMPLETE: 7909 ROW= 332

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 107668 TOTAL) 107668 DRY DENSITY(Kg/L)) 1.47
COSTS: CAPITAL CONTAINMENT) 2 O&M CONTAINMENT) 0 DREDGING $/CMPM) 3.68 TOTAL $/CMPM) 5.80

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	11.000	11.000	11.000	17350.70	COD (mg/g)	83.200	83.200	83.200	13123.44
O&G (mg/g)	5.230	5.230	5.230	824.95	TKN (mg/g)	3.930	3.930	3.930	619.89
TOTAL P (mg/g)	1.660	1.660	1.660	261.84	Hg (ug/g)	0.600	0.600	0.600	0.09
Pb (ug/g)	75.000	75.000	75.000	11.83	As (ug/g)	5.700	5.700	5.700	0.90
Cd (ug/g)	9.000	9.000	9.000	1.42	Cu (ug/g)	47.000	47.000	47.000	7.41
Zn (ug/g)	194.000	194.000	194.000	30.60	Cr (ug/g)	125.000	125.000	125.000	19.72
Ni (ug/g)	36.000	36.000	36.000	5.68					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7511 COMPLETE: 7512 ROW= 317

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 461699 TOTAL) 461699 DRY DENSITY(Kg/L)) 1.45
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.02 TOTAL $/CMPM) 1.02

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.700	10.100	11.000	71632.60	COD (mg/g)	79.200	74.600	83.300	53021.51
O&G (mg/g)	1.830	0.630	5.230	1225.12	TKN (mg/g)	3.280	2.610	3.930	2195.84
TOTAL P (mg/g)	1.110	0.690	1.660	743.10	Hg (ug/g)	0.400	0.300	0.600	0.27
Pb (ug/g)	52.000	16.000	75.000	34.81	As (ug/g)	6.500	5.600	8.900	4.35
Cd (ug/g)	7.000	6.000	9.000	4.69	Cu (ug/g)	31.000	22.000	47.000	20.75
Zn (ug/g)	131.000	109.000	194.000	87.70	Cr (ug/g)	77.000	64.000	125.000	51.55
Ni (ug/g)	39.000	34.000	49.000	26.11					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7811 COMPLETE: 7901 ROW= 328

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 329486 TOTAL) 329486 DRY DENSITY(Kg/L)) 1.52
COSTS: CAPITAL CONTAINMENT) 2 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.65 TOTAL $/CMPM) 3.77

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	10.830	10.400	11.400	54238.67	COD (mg/g)	79.000	74.600	83.300	39564.68
O&G (mg/g)	1.090	0.810	1.410	545.89	TKN (mg/g)	3.280	3.090	3.390	1642.69
TOTAL P (mg/g)	0.920	0.690	1.660	460.75	Hg (ug/g)	0.400	0.300	0.500	0.20
Pb (ug/g)	43.000	16.000	60.000	21.54	As (ug/g)	7.000	6.000	9.000	3.51
Cd (ug/g)	6.000	6.000	9.000	3.00	Cu (ug/g)	24.000	22.000	26.000	12.02
Zn (ug/g)	113.000	109.000	117.000	56.59	Cr (ug/g)	65.000	54.000	74.000	32.55
Ni (ug/g)	37.000	34.000	39.000	18.53					

OTHER PARAMETERS Fe
SAMPLING DATES: EPA-270373

LOCATION: TOLEDO HARBOR , OH BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7906 ROW= 333

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY) 49764 TOTAL) 49764 DRY DENSITY(Kg/L)) 1.53
COSTS: CAPITAL CONTAINMENT) 2 O&M CONTAINMENT) 0 DREDGING $/CMPM) 9.81 TOTAL $/CMPM) 11.93

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.880	4.880	4.880	3703.44	COD (mg/g)	96.000	96.000	96.000	7285.45
O&G (mg/g)	0.800	0.800	0.800	60.71	TKN (mg/g)	2.900	2.900	2.900	220.08
NH3 (mg/g)	0.400	0.400	0.400	30.36	TOTAL P (mg/g)	1.300	1.300	1.300	98.66
Hg (ug/g)	0.400	0.400	0.400	0.03	Pb (ug/g)	62.000	62.000	62.000	4.71
As (ug/g)	8.000	8.000	8.000	0.61	Cd (ug/g)	3.000	3.000	3.000	0.23
Cu (ug/g)	51.000	51.000	51.000	3.87	Zn (ug/g)	208.000	208.000	208.000	15.79
Cr (ug/g)	94.000	94.000	94.000	7.13	Ni (ug/g)	58.000	58.000	58.000	4.40

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-110975

LOCATION: VERMILION , OH BASIN: ERIE PROJECT BEGAN: 7512 COMPLETE: 7603 ROW= 237

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 6540 TOTAL) 3731 DRY DENSITY(Kg/L)) 1.60
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.80 TOTAL $/CMPM) 1.80

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.300	3.300	3.300	197.00	COD (mg/g)	36.000	36.000	36.000	214.91
O&G (mg/g)	0.400	0.400	0.400	2.39	TKN (mg/g)	0.740	0.740	0.740	4.42
NH3 (mg/g)	0.060	0.060	0.060	0.36	TOTAL P (mg/g)	0.370	0.370	0.370	2.21
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	16.000	16.000	16.000	0.10
As (ug/g)	11.000	11.000	11.000	0.07	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.01
Cu (ug/g)	21.000	21.000	21.000	0.13	Zn (ug/g)	120.000	120.000	120.000	0.72
Cr (ug/g)	27.000	27.000	27.000	0.16	Ni (ug/g)	32.000	32.000	32.000	0.19

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO
SAMPLING DATES: EPA-090475

LOCATION: VERMILION , OH BASIN: ERIE PROJECT BEGAN: 7810 COMPLETE: 7811 ROW= 202

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 2673 TOTAL: 4338 DRY DENSITY(Kg/L): 1.71
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 7.93 TOTAL $/CMPM: 7.93

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.300	3.300	3.300	244.36	COD (mg/g)	36.000	36.000	36.000	266.58
O&G (mg/g)	0.400	0.400	0.400	2.96	TKN (mg/g)	0.740	0.740	0.740	5.48
NH3 (mg/g)	0.060	0.060	0.060	0.44	TOTAL P (mg/g)	0.370	0.370	0.370	2.74
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	16.000	16.000	16.000	0.12
As (ug/g)	11.000	11.000	11.000	0.08	Cd (ug/g)	< 1.000	< 1.000	< 1.000	< 0.01
Cu (ug/g)	21.000	21.000	21.000	0.16	Zn (ug/g)	120.000	120.000	120.000	0.89
Cr (ug/g)	27.000	27.000	27.000	0.20	Ni (ug/g)	32.000	32.000	32.000	0.24

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO
SAMPLING DATES: EPA-090475

LOCATION: VERMILION , OH BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7912 ROW= 310

PHYSICAL DATA

MATERIAL: SILT/SAND DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY: 8907 TOTAL: 8907 DRY DENSITY(Kg/L): 1.63
COSTS: CAPITAL CONTAINMENT: 6 O&M CONTAINMENT: 0 DREDGING $/CMPM: 17.60 TOTAL $/CMPM: 23.83

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.300	3.300	3.300	477.64	COD (mg/g)	36.000	36.000	36.000	521.06
O&G (mg/g)	0.400	0.400	0.400	5.79	TKN (mg/g)	0.740	0.740	0.740	10.71
NH3 (mg/g)	0.060	0.060	0.060	0.87	TOTAL P (mg/g)	0.370	0.370	0.370	5.36
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	16.000	16.000	16.000	0.23
As (ug/g)	11.000	11.000	11.000	0.16	Cd (ug/g)	1.000	< 1.000	< 1.000	< 0.01
Cu (ug/g)	21.000	21.000	21.000	0.30	Zn (ug/g)	120.000	120.000	120.000	1.74
Cr (ug/g)	27.000	27.000	27.000	0.39	Ni (ug/g)	32.000	32.000	32.000	0.46

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO
SAMPLING DATES: EPA-090475

LOCATION: VERMILION , OH BASIN: ERIE PROJECT BEGAN: 7910 COMPLETE: 7912 ROW= 311

PHYSICAL DATA

MATERIAL: GRAVEL DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 15720 TOTAL; 15720 DRY DENSITY(Kg/L); 1.68
COSTS: CAPITAL CONTAINMENT; 0 . O&M CONTAINMENT; 0 DREDGING $/CMPM; 8.38 TOTAL $/CMPM; 8.38

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.800	4.000	7.500	1527.20	COD (mg/g)	63.600	43.000	80.000	1674.65
O&G (mg/g)	0.570	< 0.200	0.900	< 15.01	TKN (mg/g)	1.660	1.000	2.400	43.71
NH3 (mg/g)	0.151	0.046	0.350	3.98	TOTAL P (mg/g)	0.604	0.380	0.900	15.90
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	27.000	22.000	34.000	0.71
As (ug/g)	15.000	12.000	19.000	0.39	Cd (ug/g)	1.000	< 1.000	2.300	< 0.03
Cu (ug/g)	28.000	21.000	38.000	0.74	Zn (ug/g)	169.000	110.000	240.000	4.45
Cr (ug/g)	38.000	25.000	62.000	1.00	Ni (ug/g)	45.000	32.000	68.000	1.18

OTHER PARAMETERS Ba,CN,Fe,Mn,Mg,PHENO
SAMPLING DATES: EPA-090475

LOCATION: ERIE HARBOR , PA BASIN: ERIE PROJECT BEGAN: 7510 COMPLETE: 7512 ROW= 229

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 122336 TOTAL; 142980 DRY DENSITY(Kg/L); 1.51
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.01 TOTAL $/CMPM; 2.01

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.530	0.770	3.960	5455.03	COD (mg/g)	27.600	9.000	45.000	5950.94
O&G (mg/g)	0.600	0.400	0.900	129.37	TKN (mg/g)	0.750	0.160	1.300	161.71
NH3 (mg/g)	0.053	0.006	0.063	11.43	TOTAL P (mg/g)	0.470	0.190	0.610	101.34
Pb (ug/g)	24.000	14.000	30.000	5.17	As (ug/g)	9.000	4.000	11.000	1.94
Cd (ug/g)	4.000	1.000	6.000	0.86	Cu (ug/g)	32.000	7.000	43.000	6.90
Zn (ug/g)	89.000	35.000	120.000	19.19	Cr (ug/g)	23.000	7.000	30.000	4.96
Ni (ug/g)	37.000	20.000	50.000	7.98					

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-060375

LOCATION: ERIE HARBOR , PA BASIN: ERIE PROJECT BEGAN: 7604 COMPLETE: 7605 ROW= 257

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 97777 TOTAL) 116892 DRY DENSITY(Kg/L)) 1.45

COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 2.23 TOTAL $/CMPM) 2.23

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.430	0.770	3.960	4121.53	COD (mg/g)	26.400	9.000	45.000	4477.71
O&G (mg/g)	0.550	0.400	0.900	93.29	TKN (mg/g)	0.720	0.160	1.300	122.12
NH3 (mg/g)	0.045	0.006	0.063	7.63	TOTAL P (mg/g)	0.490	0.190	0.610	83.11
Pb (ug/g)	24.000	14.000	30.000	4.07	As (ug/g)	10.000	4.000	11.000	1.70
Cd (ug/g)	4.000	1.000	6.000	0.68	Cu (ug/g)	32.000	7.000	43.000	5.43
Zn (ug/g)	91.000	35.000	120.000	15.43	Cr (ug/g)	22.000	7.000	30.000	3.73
Ni (ug/g)	38.000	20.000	50.000	6.45					

OTHER PARAMETERS Ba,Fe,Mn,Mg,Hg

SAMPLING DATES: EPA-060375

LOCATION: ERIE HARBOR , PA BASIN: ERIE PROJECT BEGAN: 7704 COMPLETE: 7704 ROW= 214

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: LAKE DUMP

EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY) 97172 TOTAL) 97172 DRY DENSITY(Kg/L)) 1.58

COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 1.58 TOTAL $/CMPM) 1.58

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.530	0.770	3.960	3884.35	COD (mg/g)	27.600	9.000	45.000	4237.48
O&G (mg/g)	0.600	0.400	0.900	92.12	TKN (mg/g)	0.750	0.160	1.300	115.15
NH3 (mg/g)	0.053	0.006	0.063	8.14	TOTAL P (mg/g)	0.470	0.190	0.610	72.16
Pb (ug/g)	24.000	14.000	30.000	3.68	As (ug/g)	9.000	4.000	11.000	1.38
Cd (ug/g)	4.000	1.000	6.000	0.61	Cu (ug/g)	32.000	7.000	43.000	4.91
Zn (ug/g)	89.000	35.000	120.000	13.66	Cr (ug/g)	23.000	7.000	30.000	3.53
Ni (ug/g)	37.000	20.000	50.000	5.68					

OTHER PARAMETERS Mn,Ba,Mg,Fe

SAMPLING DATES: USEPA-060375

LOCATION: ERIE HARBOR , PA BASIN: ERIE PROJECT BEGAN: 7905 COMPLETE: 7905 ROW= 292

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: LAKE DUMP
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 22094 TOTAL) 22145 DRY DENSITY(Kg/L)) 1.58
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 3.62 TOTAL $/CMPM) 3.62

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.430	2.120	2.740	850.24	COD (mg/g)	26.500	23.000	30.000	927.21
O&G (mg/g)	0.500	0.400	0.600	17.49	TKN (mg/g)	0.680	0.610	0.740	23.79
NH3 (mg/g)	0.042	0.020	0.063	1.47	TOTAL P (mg/g)	0.580	0.540	0.610	20.29
Pb (ug/g)	25.000	24.000	25.000	0.87	As (ug/g)	11.000	11.000	11.000	0.38
Cd (ug/g)	4.000	4.000	4.000	0.14	Cu (ug/g)	38.000	32.000	43.000	1.33
Zn (ug/g)	104.000	95.000	112.000	3.64	Cr (ug/g)	25.000	20.000	30.000	0.87
Ni (ug/g)	45.000	40.000	50.000	1.57					

OTHER PARAMETERS Ba,Fe,Mn,Mg
SAMPLING DATES: EPA-060375

LOCATION: COBOURG , ON BASIN: ONTARIO PROJECT BEGAN: 7609 COMPLETE: 7612 ROW= 33

PHYSICAL DATA

MATERIAL: SAND, SILT CLAY DISPOSAL METHOD: OPEN LAKE- LAT 4356N, LONG 7809W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 21784 TOTAL) 33592 DRY DENSITY(Kg/L)) 1.70
COSTS: CAPITAL CONTAINMENT) 0 O&M CONTAINMENT) 0 DREDGING $/CMPM) 4.47 TOTAL $/CMPM) 4.67

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.300	0.500	3.900	1313.45	COD (mg/g)	20.800	23.000	30.700	1187.81
O&G (mg/g)	0.520	0.190	0.920	29.70	TKN (mg/g)	0.600	0.100	1.000	34.26
TOTAL P (mg/g)	0.700	0.550	0.840	39.97	Hg (ug/g)	0.120	0.050	0.180	0.01

SAMPLING DATES:

LOCATION: COBOURG , ON BASIN: ONTARIO PROJECT BEGAN: 7704 COMPLETE: 7707 ROW= 34

PHYSICAL DATA

MATERIAL: SAND, SILT CLAY DISPOSAL METHOD: OPEN LAKE- LAT 435610N, LONG 780932W

EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 11390 TOTAL; 16000 DRY DENSITY(Kg/L); 1.70

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.16 TOTAL $/CMPM; 6.34

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.300	0.500	3.900	625.60	COD (mg/g)	20.800	23.000	30.700	565.76
O&G (mg/g)	0.520	0.190	0.920	14.14	TKN (mg/g)	0.600	0.100	1.000	16.32
TOTAL P (mg/g)	0.700	0.550	0.840	19.04	Hg (ug/g)	0.120	0.050	0.180	0.00

SAMPLING DATES:

LOCATION: COBOURG , ON BASIN: ONTARIO PROJECT BEGAN: 7809 COMPLETE: 7812 ROW= 35

PHYSICAL DATA

MATERIAL: SAND, SILT DISPOSAL METHOD: OPEN LAKE- LAT 435608N, LONG 780930W

EQUIPMENT TYPE: DIPPER

QUANTITY(CMPM): PAY; 10302 TOTAL; 14400 DRY DENSITY(Kg/L); 1.70

COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 9.88 TOTAL $/CMPM; 10.50

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.300	0.500	3.900	563.04	COD (mg/g)	20.800	23.000	30.700	509.18
O&G (mg/g)	0.520	0.190	0.920	12.73	TKN (mg/g)	0.600	0.100	1.000	14.69
TOTAL P (mg/g)	0.700	0.550	0.840	17.14	Hg (ug/g)	0.120	0.050	0.180	0.00

SAMPLING DATES:

348

LOCATION: HAMILTON , ON BASIN: ONTARIO PROJECT BEGAN: 7808 COMPLETE: 7810 ROW= 37

PHYSICAL DATA

MATERIAL: ORGANIC SILT DISPOSAL METHOD: CONFINED, BAYSIDE DISPOSAL FACILITY
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 27729 TOTAL; 41600 DRY DENSITY(Kg/L)) 1.30
COSTS: CAPITAL CONTAINMENT; 85000 O&M CONTAINMENT; 10000 DREDGING $/CMPM; 4.56 TOTAL $/CMPM; 8.24

REMARKS: MAIN CHANNEL. / CONT. BERM COSTS PRORATED TO REFLECT COSTS

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: HAMILTON , ON BASIN: ONTARIO PROJECT BEGAN: 7804 COMPLETE: 7805 ROW= 36

PHYSICAL DATA

MATERIAL: SILT ORGANIC SILT DISPOSAL METHOD: CONFINED, INNER END OF SLIP BETWEEN PIERS 12 & 13
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 87130 TOTAL; 104600 DRY DENSITY(Kg/L)) 1.30
COSTS: CAPITAL CONTAINMENT; 286502 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.04 TOTAL $/CMPM; 6.53

REMARKS: PIER 12 & 13. / BERM 1-DREDGING CONTAINMENT. BERM 2-40% CONTAINMENT

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: HAMILTON , ON BASIN: ONTARIO PROJECT BEGAN: 7610 COMPLETE: 7611 ROW= 38

PHYSICAL DATA

MATERIAL: ORGANIC SILT SAND DISPOSAL METHOD: CONFINED, BAYSIDE DISPOSAL FACILITY
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 87346 TOTAL; 127766 DRY DENSITY(Kg/L); 1.30
COSTS: CAPITAL CONTAINMENT; 265000 O&M CONTAINMENT; 10000 DREDGING $/CMPM; 2.81 TOTAL $/CMPM; 6.03

REMARKS: TOTAL CONT. 1567000.00. GENERAL HARBOUR SURVEY

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: LONG POINT (AMHERST ISLAND) , ON BASIN: ONTARIO PROJECT BEGAN: 7809 COMPLETE: 7811 ROW= 3

PHYSICAL DATA

MATERIAL: GRAVEL, SAND DISPOSAL METHOD: OPEN LAKE-LAT 440550N, LONG 764210W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 1465 TOTAL; 1800 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 12.04 TOTAL $/CMPM; 13.75

REMARKS: MAINTENANCE DREDGING

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: OSHAWA , ON BASIN: ONTARIO PROJECT BEGAN: 7908 COMPLETE: 7910 ROW= 40

PHYSICAL DATA

MATERIAL: SILT, CLAY DISPOSAL METHOD: CONFINED, DYKED AREA EAST OF EAST WHARF
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 47170 TOTAL; 61000 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 54395 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.29 TOTAL $/CMPM; 5.61

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.900	5.600	6.600	5758.40	COD (mg/g)	80.800	71.500	90.700	7886.08
O&G (mg/g)	1.560	0.990	2.190	152.26	TKN (mg/g)	1.590	1.220	1.880	155.18
TOTAL P (mg/g)	1.060	0.970	1.160	103.46	PCB (ug/g)	1.267	0.860	1.640	0.12
Hg (ug/g)	0.130	0.040	0.250	0.01	Pb (ug/g)	55.000	21.000	73.000	5.37
As (ug/g)	2.800	2.000	6.000	0.27	Cu (ug/g)	14.600	9.000	21.000	1.42
Zn (ug/g)	124.000	88.000	179.000	12.10	Cr (ug/g)	129.000	110.000	151.000	12.59
Ni (ug/g)	79.000	41.000	106.000	7.71					

SAMPLING DATES:

LOCATION: OSHAWA , ON BASIN: ONTARIO PROJECT BEGAN: 7708 COMPLETE: 7809 ROW= 28

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: OPEN LAKE- LAT 4351N, LONG 7849W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 7312 TOTAL; 10200 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 9.61 TOTAL $/CMPM; 10.67

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.500	0.700	5.200	408.00	COD (mg/g)	24.500	5.550	63.800	399.84
O&G (mg/g)	0.693	0.420	1.230	11.31	TKN (mg/g)	0.580	0.030	1.440	9.47
TOTAL P (mg/g)	0.590	0.470	0.630	9.63	Hg (ug/g)	0.060	0.020	0.110	0.00

SAMPLING DATES:

LOCATION: OSHAWA , ON BASIN: ONTARIO PROJECT BEGAN: 7809 COMPLETE: 7812 ROW= 26

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: OPEN LAKE- LAT 435110N, LONG 784833W
EQUIPMENT TYPE: CLAM
QUANTITY(CMPM): PAY: 24671 TOTAL: 34500 DRY DENSITY(Kg/L): 1.60
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 6.40 TOTAL $/CMPM: 6.65

REMARKS: APPROACH

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.500	0.700	5.200	1380.00	COD (mg/g)	24.500	5.550	63.800	1352.40
O&G (mg/g)	0.693	0.420	1.230	38.25	TKN (mg/g)	0.580	0.030	1.440	32.02
TOTAL P (mg/g)	0.590	0.470	0.630	32.57	Hg (ug/g)	0.060	0.020	0.110	0.00

SAMPLING DATES:

351

LOCATION: OSHAWA , ON BASIN: ONTARIO PROJECT BEGAN: 7803 COMPLETE: 7806 ROW= 27

PHYSICAL DATA

MATERIAL: ORGANIC CLAY & DEBRIS DISPOSAL METHOD: LAND, BY TRUCK IN HARBOUR
EQUIPMENT TYPE: BACKHOE
QUANTITY(CMPM): PAY: 62078 TOTAL: 65000 DRY DENSITY(Kg/L): 1.30
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 2.42 TOTAL $/CMPM: 2.51

REMARKS: CRUISE MARINA

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: PORT CREDIT , ON BASIN: ONTARIO PROJECT BEGAN: 7512 COMPLETE: 7604 ROW= 32

PHYSICAL DATA

MATERIAL: ORGANIC SILTS DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 3930 TOTAL; 4700 DRY DENSITY(Kg/L); 1.20
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 8.70 TOTAL $/CMPM; 9.21

REMARKS: HIGH COST DUE TO TRUCKING

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.200	2.400	6.200	236.88	COD (mg/g)	52.000	29.000	73.000	293.28
O&G (mg/g)	3.300	1.000	7.000	18.61	TKN (mg/g)	1.800	1.200	4.200	10.15
TOTAL P (mg/g)	0.330	0.210	0.460	1.86					

SAMPLING DATES:

LOCATION: PORT CREDIT , ON BASIN: ONTARIO PROJECT BEGAN: COMPLETE: ROW= 267

PHYSICAL DATA

MATERIAL: SAND, CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 4600 TOTAL; 4600 DRY DENSITY(Kg/L); 0.95
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	5.700	1.600	9.500	249.09	COD (mg/g)	53.438	10.300	101.900	233.52
O&G (mg/g)	6.560	0.427	17.800	28.67	TKN (mg/g)	2.042	0.140	4.020	8.92
TOTAL P (mg/g)	0.410	0.001	1.300	1.79	Hg (ug/g)	0.060	0.030	0.120	0.00
Pb (ug/g)	39.000	10.000	56.000	0.17	Zn (ug/g)	97.000	27.000	147.000	0.42

SAMPLING DATES: MOE-1975, DOE-1977

LOCATION: PORT HOPE , ON BASIN: ONTARIO PROJECT BEGAN: 7907 COMPLETE: 7908 ROW= 39

PHYSICAL DATA

MATERIAL: SAND SILT DISPOSAL METHOD: OPEN LAKE- LAT 435612N, LONG 781654W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 20883 TOTAL; 28000 DRY DENSITY(Kg/L); 1.60
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 5.82 TOTAL $/CMPM; 5.98

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.700	0.000	0.000	1209.60	COD (mg/g)	19.000	0.000	0.000	851.20
O&G (mg/g)	0.460	0.000	0.000	20.61	TOTAL P (mg/g)	0.630	0.000	0.000	28.22

SAMPLING DATES:

353

LOCATION: POINT TRAVERSE , ON BASIN: ONTARIO PROJECT BEGAN: 7611 COMPLETE: 7705 ROW= 5

PHYSICAL DATA

MATERIAL: SANDS / GRAVEL DISPOSAL METHOD: OPEN LAKE-+3800 LAT 435745N, LONG 765115W LAND-^1000
EQUIPMENT TYPE: CLAM, DRAGLINE

QUANTITY(CMPM): PAY; 4038 TOTAL; 4800 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 4.89 TOTAL $/CMPM; 5.64

REMARKS: MOSTLY GRAVEL REUSED BY CONTRACTOR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)

NO CHEMICAL DATA
SAMPLING DATES:

LOCATION: TORONTO HARBOUR , ON BASIN: ONTARIO PROJECT BEGAN: COMPLETE: ROW= 239

PHYSICAL DATA

MATERIAL: SILT,CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 44100 TOTAL; 44100 DRY DENSITY(Kg/L); 1.30
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING \$/CMPM; 0.00 TOTAL \$/CMPM; 0.00

REMARKS: DENSITY ESTIMATED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.100	6.600	9.600	4070.43	O&G (mg/g)	4.200	0.543	11.100	240.79
TKN (mg/g)	1.700	0.540	3.940	97.46	TOTAL P (mg/g)	1.188	0.860	1.600	68.11
PCB (ug/g)	0.230	0.060	0.390	0.01	Hg (ug/g)	0.250	0.110	0.300	0.01
Pb (ug/g)	175.000	74.000	254.000	10.03	Cu (ug/g)	45.000	20.000	80.000	2.58
Zn (ug/g)	230.000	82.000	340.000	13.19	Cr (ug/g)	47.000	13.000	86.000	2.69
Ni (ug/g)	18.000	7.000	28.000	1.03					

SAMPLING DATES: EC-1978,MOE-1972,1973,1976

LOCATION: TORONTO HARBOUR , ON BASIN: ONTARIO PROJECT BEGAN: COMPLETE: ROW= 240

PHYSICAL DATA

MATERIAL: SILT, CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 3662 TOTAL; 3662 DRY DENSITY(Kg/L); 1.30
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING \$/CMPM; 0.00 TOTAL \$/CMPM; 0.00

REMARKS: DENSITY ESTIMATED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.100	6.600	9.600	338.00	O&G (mg/g)	4.200	0.543	11.100	19.99
TKN (mg/g)	1.700	0.540	3.940	8.09	TOTAL P (mg/g)	1.188	0.860	1.600	5.66
PCB (ug/g)	0.230	0.060	0.390	0.00	Hg (ug/g)	0.250	0.110	0.300	0.00
Pb (ug/g)	175.000	74.000	254.000	0.83	Cu (ug/g)	45.000	20.000	80.000	0.21
Zn (ug/g)	230.000	82.000	340.000	1.09	Cr (ug/g)	47.000	13.000	86.000	0.22
Ni (ug/g)	18.000	7.000	28.000	0.09					

SAMPLING DATES: EC-1978, MOE-1972,1973,1976

LOCATION: TORONTO HARBOUR , ON BASIN: ONTARIO PROJECT BEGAN: COMPLETE: ROW= 252

PHYSICAL DATA

MATERIAL: SILT, CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 13341 TOTAL; 13341 DRY DENSITY(Kg/L) 1.30
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DENSITY ESTIMATED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.100	6.600	9.600	1231.37	O&G (mg/g)	4.200	0.543	11.100	72.84
TKN (mg/g)	1.700	0.540	3.940	29.48	TOTAL P (mg/g)	1.188	0.860	1.600	20.60
PCB (ug/g)	0.230	0.060	0.390	0.00	Hg (ug/g)	0.250	0.110	0.300	0.00
Pb (ug/g)	175.000	74.000	254.000	3.04	Cu (ug/g)	45.000	20.000	80.000	0.78
Zn (ug/g)	230.000	82.000	340.000	3.99	Cr (ug/g)	47.000	13.000	86.000	0.82
Ni (ug/g)	18.000	7.000	28.000	0.31					

SAMPLING DATES: EC-1978, MOE-1972,1973,1976

355

LOCATION: TORONTO HARBOUR ON BASIN: ONTARIO PROJECT BEGAN: COMPLETE: ROW= 253

PHYSICAL DATA

MATERIAL: SILT, CLAY DISPOSAL METHOD: CONFINED
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 3392 TOTAL; 3392 DRY DENSITY(Kg/L) 1.30
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 0.00 TOTAL $/CMPM; 0.00

REMARKS: DENSITY ESTIMATED

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	7.100	6.600	9.600	313.08	O&G (mg/g)	4.200	0.543	11.100	18.52
TKN (mg/g)	1.700	0.540	3.940	7.50	TOTAL P (mg/g)	1.188	0.860	1.600	5.24
PCB (ug/g)	0.230	0.060	0.390	0.00	Hg (ug/g)	0.250	0.110	0.300	0.00
Pb (ug/g)	175.000	74.000	254.000	0.77	Cu (ug/g)	45.000	20.000	80.000	0.20
Zn (ug/g)	230.000	82.000	340.000	1.01	Cr (ug/g)	47.000	13.000	86.000	0.21
Ni (ug/g)	18.000	7.000	28.000	0.08					

SAMPLING DATES: EC-1978, MOE-1972,1973,1976

LOCATION: WHITBY , ON BASIN: ONTARIO PROJECT BEGAN: 7806 COMPLETE: 7811 ROW= 29

PHYSICAL DATA

MATERIAL: ORG. PEAT CLAY, SILT DISPOSAL METHOD: CONFINED IN HARBOUR
EQUIPMENT TYPE: HYDRAULIC

QUANTITY(CMPM): PAY; 156955 TOTAL; 188300 DRY DENSITY(Kg/L); 0.90
COSTS: CAPITAL CONTAINMENT; 265000 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.93 TOTAL $/CMPM; 4.94

REMARKS:

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	18.200	2.800	75.100	30843.54	COD (mg/g)	271.000	7.400	936.000	45926.37
O&G (mg/g)	1.740	0.400	5.100	294.88	TKN (mg/g)	3.500	0.200	10.500	593.15
TOTAL P (mg/g)	0.860	0.040	3.150	145.74	PCB (ug/g)	0.180	< 0.010	0.850	< 0.03
Hg (ug/g)	0.150	0.020	0.300	0.03	Pb (ug/g)	73.000	18.000	115.000	12.37
As (ug/g)	4.500	2.000	14.000	0.76	Cu (ug/g)	83.000	29.000	133.000	14.07
Zn (ug/g)	207.000	104.000	370.000	35.08	Cr (ug/g)	155.000	79.000	191.000	26.27
Ni (ug/g)	82.000	32.000	138.000	13.90					

OTHER PARAMETERS Co,S,PESTICIDES
SAMPLING DATES:

LOCATION: GREAT SODUS BAY HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7506 COMPLETE: 7508 ROW= 63

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4318N, LONG 7657W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 6422 TOTAL; 8278 DRY DENSITY(Kg/L); 1.90
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 6.51 TOTAL $/CMPM; 6.51

REMARKS: STA 33 THRU 38

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.470	0.470	0.470	74.00	COD (mg/g)	2.000	2.000	2.000	31.49
O&G (mg/g)	1.120	1.120	1.120	17.63	TKN (mg/g)	2.270	2.270	2.270	35.74
NH3 (mg/g)	0.206	0.206	0.206	3.24	TOTAL P (mg/g)	1.970	1.970	1.970	31.02

OTHER PARAMETERS BOD
SAMPLING DATES: USDI/FWPCA-280668

LOCATION: LITTLE SODUS BAY HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7509 COMPLETE: 7509 ROW= 65

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: BEACH NOURISHMENT
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 1436 TOTAL: 1612 DRY DENSITY(Kg/L): 2.21
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 7.54 TOTAL $/CMPM: 7.54

REMARKS: STA 4 THRU 34

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	0.350	0.350	0.350	12.47	COD (mg/g)	5.400	5.100	5.700	19.24
O&G (mg/g)	< 0.001	< 0.001	< 0.001	< 0.00	TKN (mg/g)	0.230	0.186	0.274	0.82
Hg (ug/g)	< 0.010	< 0.010	< 0.010	< 0.00	Pb (ug/g)	0.620	0.610	0.620	0.00
Zn (ug/g)	4.700	2.000	7.400	0.02					

SAMPLING DATES: EPA-050772

LOCATION: OGDENSBURG HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7710 COMPLETE: 7711 ROW= 71

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: CONFINED-NY STATE FISH HATCHERY
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 24251 TOTAL: 26703 DRY DENSITY(Kg/L): 1.58
COSTS: CAPITAL CONTAINMENT: 9 O&M CONTAINMENT: 0 DREDGING $/CMPM: 5.53 TOTAL $/CMPM: 14.71

REMARKS: STA 210 THRU 237 DRGED. DATA AVG OVER ENTIRE HBR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.040	1.380	4.110	859.60	COD (mg/g)	196.600	150.000	254.000	8284.20
O&G (mg/g)	4.930	3.400	6.800	207.74	TKN (mg/g)	0.870	0.670	1.200	36.66
NH3 (mg/g)	0.190	0.100	0.500	8.01	TOTAL P (mg/g)	0.170	0.120	0.240	7.16
PCB (ug/g)	7.000	< 1.000	7.000	0.29	Hg (ug/g)	0.400	0.300	0.400	0.02
Pb (ug/g)	88.000	55.000	115.000	3.71	As (ug/g)	7.000	3.000	9.000	0.29
Cd (ug/g)	2.900	2.300	4.200	0.12	Cu (ug/g)	50.000	31.000	69.000	2.11
Zn (ug/g)	866.000	790.000	1100.000	36.49	Cr (ug/g)	37.000	22.000	50.000	1.56
Ni (ug/g)	39.000	20.000	55.000	1.64					

OTHER PARAMETERS Fe, Mg, Mn
SAMPLING DATES: EPA-270776

LOCATION: OSWEGO HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7508 COMPLETE: 7509 ROW= 64

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4329N, LONG 7632W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 69385 TOTAL; 82979 DRY DENSITY(Kg/L); 1.62
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING \$/CMPM; 2.24 TOTAL \$/CMPM; 2.24

REMARKS: WEST BASIN & RIVER ENTRANCE CHANNEL

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.950	2.360	6.100	5309.83	COD (mg/g)	47.600	18.000	87.000	6398.68
O&G (mg/g)	0.890	0.400	1.400	119.64	TKN (mg/g)	1.070	0.520	2.300	143.84
NH3 (mg/g)	0.086	0.049	0.120	11.56	TOTAL P (mg/g)	0.810	0.560	1.800	108.89
Hg (ug/g)	0.100	< 0.100	0.100	< 0.01	Pb (ug/g)	49.000	17.000	148.000	6.59
As (ug/g)	9.000	7.000	11.000	1.21	Cd (ug/g)	1.400	< 1.000	2.600	< 0.19
Cu (ug/g)	36.000	17.000	54.000	4.84	Zn (ug/g)	110.000	60.000	140.000	14.79
Cr (ug/g)	17.000	10.000	24.000	2.29	Ni (ug/g)	17.000	9.000	24.000	2.29

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-220476

LOCATION: OSWEGO HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7610 COMPLETE: 7610 ROW= 67

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4329N, LONG 7632W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 24926 TOTAL; 30737 DRY DENSITY(Kg/L); 1.42
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING \$/CMPM; 2.60 TOTAL \$/CMPM; 2.60

REMARKS: WEST BASIN OUTER HARBOR

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.170	2.360	6.100	1821.34	COD (mg/g)	54.200	27.000	87.000	2367.31
O&G (mg/g)	0.820	0.400	1.000	35.82	TKN (mg/g)	1.250	0.520	2.300	54.60
NH3 (mg/g)	0.096	0.071	0.120	4.19	TOTAL P (mg/g)	0.710	0.560	0.900	31.01
Hg (ug/g)	0.100	< 0.100	0.100	< 0.00	Pb (ug/g)	28.000	17.000	37.000	1.22
As (ug/g)	10.000	8.000	11.000	0.44	Cd (ug/g)	1.300	< 1.000	2.200	< 0.06
Cu (ug/g)	33.000	17.000	44.000	1.44	Zn (ug/g)	104.000	60.000	140.000	4.54
Cr (ug/g)	17.000	10.000	23.000	0.74	Ni (ug/g)	17.000	9.000	24.000	0.74

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-220476

LOCATION: OSWEGO HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7707 COMPLETE: 7708 ROW= 72

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4329N, LONG 7632W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 48033 TOTAL; 53803 DRY DENSITY(Kg/L); 1.43
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 3.95 TOTAL $/CMPM; 3.95

REMARKS: STA 40 THRU 53, STA 114 THRU 133

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.950	2.360	5.020	3032.69	COD (mg/g)	51.200	27.000	72.000	3930.98
O&G (mg/g)	0.920	0.400	1.500	70.63	TKN (mg/g)	1.220	0.520	2.200	93.67
NH3 (mg/g)	0.104	0.071	0.160	7.98	TOTAL P (mg/g)	0.730	0.560	1.000	56.05
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.01	Pb (ug/g)	31.000	17.000	47.000	2.38
As (ug/g)	9.000	8.000	11.000	0.69	Cd (ug/g)	1.600	< 1.000	3.400	< 0.12
Cu (ug/g)	32.000	17.000	42.000	2.46	Zn (ug/g)	117.000	60.000	190.000	8.98
Cr (ug/g)	11.000	10.000	30.000	0.84	Ni (ug/g)	18.000	9.000	23.000	1.38

OTHER PARAMETERS Fe,Mn,Mg
SAMPLING DATES: EPA-220476

LOCATION: OSWEGO HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7907 COMPLETE: 7907 ROW= 76

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4329N, LONG 7632W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 21398 TOTAL; 21398 DRY DENSITY(Kg/L); 1.46
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.21 TOTAL $/CMPM; 2.21

REMARKS: STA 115 TO 135

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.700	2.920	4.470	1153.54	COD (mg/g)	44.000	40.000	48.000	1371.78
O&G (mg/g)	0.850	0.800	0.900	26.50	TKN (mg/g)	0.740	0.680	0.800	23.07
NH3 (mg/g)	0.090	0.087	0.092	2.81	TOTAL P (mg/g)	0.625	0.590	0.660	19.49
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.00	Pb (ug/g)	22.000	17.000	27.000	0.69
As (ug/g)	9.000	8.000	10.000	0.28	Cd (ug/g)	1.100	< 1.000	1.200	< 0.03
Cu (ug/g)	33.000	26.000	40.000	1.03	Zn (ug/g)	99.000	78.000	120.000	3.09
Cr (ug/g)	16.000	14.000	17.000	0.50	Ni (ug/g)	18.000	16.000	20.000	0.56

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-220476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7509 COMPLETE: 7510 ROW= 66

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 137910 TOTAL: 200539 DRY DENSITY(Kg/L): 1.50
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 1.15 TOTAL $/CMPM: 1.15

REMARKS: STA 35 THRU 199

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.090	< 1.000	4.500	< 9276.39	COD (mg/g)	30.000	12.000	41.000	9006.21
O&G (mg/g)	0.710	0.300	1.000	213.15	TKN (mg/g)	0.810	< 0.100	1.200	< 243.17
NH3 (mg/g)	0.078	0.024	0.110	23.42	TOTAL P (mg/g)	0.570	0.340	0.770	171.12
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.03	Pb (ug/g)	31.000	9.000	39.000	9.31
As (ug/g)	9.000	3.000	16.000	2.70	Cd (ug/g)	3.700	< 1.000	6.800	< 1.11
Cu (ug/g)	25.000	4.400	35.000	7.51	Zn (ug/g)	120.000	64.000	200.000	36.02
Cr (ug/g)	20.000	6.000	28.000	6.00	Ni (ug/g)	20.000	10.000	24.000	6.00

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-200476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7610 COMPLETE: 7612 ROW= 68

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 67285 TOTAL: 94046 DRY DENSITY(Kg/L): 1.53
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.79 TOTAL $/CMPM: 4.79

REMARKS: STA 170 THRU 200

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.250	2.270	4.500	4682.55	COD (mg/g)	20.700	12.000	29.000	2982.42
O&G (mg/g)	0.600	0.300	1.000	86.45	TKN (mg/g)	0.430	0.280	0.630	61.95
NH3 (mg/g)	0.066	0.040	0.110	9.51	TOTAL P (mg/g)	0.437	0.350	0.480	62.96
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.01	Pb (ug/g)	33.000	31.000	36.000	4.75
As (ug/g)	9.000	7.000	10.000	1.30	Cd (ug/g)	2.800	< 1.000	4.500	< 0.40
Cu (ug/g)	24.000	19.000	28.000	3.46	Zn (ug/g)	107.000	130.000	82.000	15.42
Cr (ug/g)	19.000	14.000	23.000	2.74	Ni (ug/g)	19.000	15.000	22.000	2.74

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-200476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7705 COMPLETE: 7707 ROW= 70

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 94426 TOTAL: 103601 DRY DENSITY(Kg/L): 1.58
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 4.81 TOTAL $/CMPM: 4.81

REMARKS: STA 78 THRU 153

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.370	3.080	3.620	5498.88	COD (mg/g)	36.000	30.000	41.000	5874.18
O&G (mg/g)	0.770	0.500	1.000	125.64	TKN (mg/g)	1.020	0.700	1.100	166.44
NH3 (mg/g)	0.091	0.061	0.098	14.85	TOTAL P (mg/g)	0.680	0.600	0.770	110.96
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.02	Pb (ug/g)	33.000	24.000	39.000	5.38
As (ug/g)	11.000	4.000	16.000	1.79	Cd (ug/g)	4.300	1.000	6.800	0.70
Cu (ug/g)	29.000	27.000	34.000	4.73	Zn (ug/g)	146.000	110.000	170.000	23.82
Cr (ug/g)	22.000	18.000	28.000	3.59	Ni (ug/g)	22.000	19.000	23.000	3.59

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-200476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7806 COMPLETE: 7808 ROW= 74

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY: 205589 TOTAL: 246502 DRY DENSITY(Kg/L): 1.58
COSTS: CAPITAL CONTAINMENT: 0 O&M CONTAINMENT: 0 DREDGING $/CMPM: 3.41 TOTAL $/CMPM: 3.41

REMARKS: STA 40 THRU 200

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.090	< 1.000	4.500	< 12065.19	COD (mg/g)	30.000	12.000	41.000	11713.78
O&G (mg/g)	0.710	0.300	1.000	277.23	TKN (mg/g)	0.810	< 0.100	1.200	< 316.27
NH3 (mg/g)	0.078	0.024	0.110	30.46	TOTAL P (mg/g)	0.570	0.340	0.770	222.56
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.04	Pb (ug/g)	31.000	9.000	39.000	12.10
As (ug/g)	9.000	3.000	16.000	3.51	Cd (ug/g)	3.700	< 1.000	6.800	< 1.44
Cu (ug/g)	25.000	4.400	35.000	9.76	Zn (ug/g)	120.000	64.000	200.000	46.86
Cr (ug/g)	20.000	6.000	28.000	7.81	Ni (ug/g)	20.000	10.000	24.000	7.81

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-200476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7905 COMPLETE: 7907 ROW= 75

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 185571 TOTAL; 216155 DRY DENSITY(Kg/L); 1.62
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 2.57 TOTAL $/CMPM; 2.57

REMARKS: STA 37 TO 91, STA 171 TO 200

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	3.070	< 1.000	4.500	< 10770.16	COD (mg/g)	28.600	12.000	41.000	10033.44
O&G (mg/g)	0.690	0.300	1.000	242.07	TKN (mg/g)	0.670	< 0.100	1.200	< 235.05
NH3 (mg/g)	0.073	0.024	0.110	25.61	TOTAL P (mg/g)	0.552	0.340	0.770	193.65
Hg (ug/g)	< 0.100	< 0.100	0.100	< 0.04	Pb (ug/g)	30.000	9.000	39.000	10.52
As (ug/g)	7.000	3.000	12.000	2.46	Cd (ug/g)	3.400	< 1.000	6.800	< 1.19
Cu (ug/g)	25.000	4.400	35.000	8.77	Zn (ug/g)	130.000	64.000	200.000	45.61
Cr (ug/g)	19.000	6.000	28.000	6.67	Ni (ug/g)	20.000	10.000	24.000	7.02

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-220476

LOCATION: ROCHESTER HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7605 COMPLETE: 7605 ROW= 69

PHYSICAL DATA

MATERIAL: SILT DISPOSAL METHOD: OPEN LAKE-LAT 4317N, LONG 7734W
EQUIPMENT TYPE: HOPPER

QUANTITY(CMPM): PAY; 102574 TOTAL; 132569 DRY DENSITY(Kg/L); 1.53
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 1.29 TOTAL $/CMPM; 1.29

REMARKS: STA 40 THRU 92

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	2.960	< 1.000	3.620	< 5995.94	COD (mg/g)	33.400	26.000	41.000	6765.69
O&G (mg/g)	0.750	0.500	1.000	151.92	TKN (mg/g)	0.810	< 0.100	1.200	< 164.08
NH3 (mg/g)	0.077	0.024	0.100	15.60	TOTAL P (mg/g)	0.620	0.340	0.770	125.59
Hg (ug/g)	< 0.100	< 0.100	< 0.100	< 0.02	Pb (ug/g)	28.000	9.000	39.000	5.67
As (ug/g)	6.000	3.000	12.000	1.22	Cd (ug/g)	3.700	< 1.000	6.800	< 0.75
Cu (ug/g)	25.000	4.400	34.000	5.06	Zn (ug/g)	143.000	64.000	200.000	28.97
Cr (ug/g)	19.000	6.000	28.000	3.85	Ni (ug/g)	20.000	10.000	23.000	4.05

OTHER PARAMETERS Fe, Mn, Mg
SAMPLING DATES: EPA-200476

LOCATION: WILSON HARBOR , NY BASIN: ONTARIO PROJECT BEGAN: 7707 COMPLETE: 7709 ROW= 73

PHYSICAL DATA

MATERIAL: SAND DISPOSAL METHOD: OPEN LAKE-LAT 4320N, LONG 7850W
EQUIPMENT TYPE: CLAM

QUANTITY(CMPM): PAY; 6837 TOTAL; 6837 DRY DENSITY(Kg/L); 1.80
COSTS: CAPITAL CONTAINMENT; 0 O&M CONTAINMENT; 0 DREDGING $/CMPM; 7.18 TOTAL $/CMPM; 7.18

REMARKS: SECTIONS 1 & 3

CHEMICAL DATA (DRY WEIGHT)

PARAMETER	MEAN	MIN	MAX	LOAD(t)	PARAMETER	MEAN	MIN	MAX	LOAD(t)
VOLATILE SOLIDS (%)	4.730	1.900	7.200	582.10	COD (mg/g)	55.800	28.000	91.000	686.71
O&G (mg/g)	0.626	0.398	0.953	7.70	TKN (mg/g)	1.560	1.060	2.163	19.20
Hg (ug/g)	0.030	< 0.010	0.060	< 0.00	Pb (ug/g)	15.600	8.200	25.500	0.19
Zn (ug/g)	42.700	32.800	49.400	0.53					

SAMPLING DATES: EPA-100872

Appendix 8

CONVERSION FACTORS

	Metric Units	English Unit Conversions
Length	1 centimetre	= 0.3937 inches
	1 metre = 100 cm	= 3.2808 feet
		= 1.0936 yards
		= 0.5468 fathoms
	1 kilometre = 100 m	= 1093.6 yards
		= 0.6241 statue miles
		= 0.5396 nautical miles
		= 0.5340 international nautical miles
Area	1 hectare = 10,000 m^2	= 2.4711 acres
	1 km^2 = 100 ha	= 0.3861 mi^2
Volume	1 litre	= 0.0353 ft^3
		= 0.2642 gal. (U.S.)
		= 0.2200 gal. (Imp.)
	1 m^3 = 1,000 L	= 1.3080 yd^3
Weight	1 gm = 1,000 mg = 10^6 µg	
	1 kilogram = 1,000 grams	= 2.2046 lbs.
	1 tonne = 1,000 kg	= 1.1023 short tons
		= 0.9842 short tons